

TABLE 4. BILL WILLIAMS WATERSHED -- 2002 ASSESSMENT -- MONITORING DATA TABLE

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED YEARS SAMPLED TYPE OF SAMPLES SAMPLING EVENTS	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Trout Creek Cow Creek-Knight Creek AZ15030201-014 A&Ww, FC, FBC, AgL	ADEQ Fixed Station Network Near Wickiup BWTRT001.79 100397	1999 - 1 suite 2000 - 5 suites	OK					
	ADEQ Biocriteria Program Above Divide Canyon BWTRT006.15 100670	1997 - 1 suite	OK					
	AGFD At canyon wall and pool BWTRT	1997 - 2 Nutrient, NH3, Metals	OK					
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining AgL Attaining	1997-2000 9 sampling events	OK				Attaining	ADEQ collected a total of 7 samples at 2 sites and AGFD collected another 2 samples in 1997-2000. Reach assessed as "attaining all uses."
Wilder Creek headwaters-Boulder Creek AZ15030202-007 A&Ww, FC, FBC, AgL, AgL	ADEQ TMDL Project M Near Boulder Creek	2001 - 6 metals, field 2002 - 1 metals, field	OK					Beryllium Laboratory Reporting Limit not low enough to assess Fish Consumption.
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive AgL Attaining	2001-2002 7 sampling events Missing core parameters.	OK				Attaining	ADEQ collected 7 samples in 2001-2002 as part of the Boulder Creek TMDL. This reach is assessed as "attaining some uses" and placed on the Planning List due to missing core parameters.
LAKES MONITORING DATA								
Alamo Lake AZL15030204-0040 A&Ww, FC, FBC, AgL	USFWS/COE Routine Monitoring BWALA	1996 - 10 suites 1997 - 11 suites 1998 - 11 suites 1999 - 9 suites 2000 - 10 suites	Sulfide mg/l	0.1 (A&Ww)	0.3-5.0	14 of 34		
			Fecal coliform CFU/100 ml	4000 ((A&Ww, FBC, AgL)	0-14,000	1 of 37		
			Turbidity NTU	25 (A&Ww)	0 - 40.4	2 of 34		
			pH (high) SU	6.5-9.0 (A&Ww, FBC AgL)	7.06-10.97	8 of 43		
			Dissolved oxygen mg/L	6.0 90% saturation (A&Ww)	0.02-14.09	8 of 36		Drying conditions

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row	1996-2000	Sulfide mg/l	0.1 (A&Ww)	0.3-5.0	14 of 34	Impaired	US Fish and Wildlife collected samples during 51 sample events in 1996-2000. Lake assessed as "Impaired" due to sulfide, high pH, and low dissolved oxygen.
	A&Ww	51 samples	Fecal coliform CFU/100 ml	4000 (A&Ww, F&C, AgL)	0-14,000	1 of 37	Attaining	
	FC		Turbidity NTU	25 (A&Ww)	0 - 40.4	2 of 34	Attaining	
	F&C		pH (high) SU	8.5-9.0 (A&Ww, F&C, AgL)	7.06-10.97	8 of 43	Impaired	
	AgL		Dissolved oxygen mg/l	6.0 (90% sat.) (A&Ww)	0.02-14.09	8 of 36	Impaired	

Information for interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from combining the following: AZ (for streams) or AZL (for lakes) + a US Geological Survey Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses," "Agency," and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year" is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
 - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among the many monitoring entities that provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
 - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
 - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."
 - Although many parameters may be analyzed, only those exceeding a standard are shown. Other parameters were collected.
 - "OK" indicates that no standards were exceeded.
 - The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
 - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
 - A mean, geometric mean, or median will be shown along with the range of results if applicable to the standard or assessment criteria.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that the exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or "Inconclusive." See assessment criteria in Chapter III of Volume I.

Ground Water Assessments in the Bill Williams Watershed

Major ground waters stressors – Monitoring data collected from the wells in this watershed between October 1995-October 2000 are summarized in **Table 5** and illustrated in **Figures 6, 7, and 8**. As **Table 5** indicates, wells are sampled for different constituents.

Only 14 wells were monitored in this watershed (**Figure 6**). This is not enough wells to make many statements about water quality. Of the wells monitored, 4 exceeded radiochemical standards and 2 exceeded the fluoride standard. No other standards were exceeded.

Total Dissolved Solids (TDS) concentration – Water quality can be characterized based on concentration of Total Dissolved Solids (**Figure 7**). High levels of salinity limit the practical uses of ground water in this watershed as TDS over 500 mg/L has an off-flavor (8 of 11 wells), and TDS over 1000 mg/L will limit its use for some crops (4 of 11 wells).

No TDS water quality standards apply in this watershed, and the elevated levels of TDS do not present a human-health concern for drinking water. The TDS concentration is only used to generally characterize water quality.

Nitrate concentration – Water quality can also be characterized by looking at the concentration of nitrates in ground water (**Figure 8**). In Arizona, natural occurring nitrate concentrations in ground water are generally below 3 mg/L and concentrations above 5 mg/L may indicate potential anthropogenic sources of nitrate. Nitrates were elevated above 5 in 3 of 11 samples. Elevated nitrates may be due to septic systems or other waste disposal problems.

When nitrate concentrations exceed 10 mg/L, Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health, as water with nitrate greater than 10 mg/L may present a health problem for babies and should not be consumed by nursing mothers. No wells exceeded this standard in this watershed; however, efforts need to continue to minimize further contamination of ground water by nitrates.

Table 5. Bill Williams Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	7		2	29%
	Fluoride	7		1	14%
	Metals/Metalloids	7		0	0%
	Nitrate	7		0	0%
	VOCs + SVOCs*	7	0	0	0%
	Pesticides	7	0	0	0%
TARGETED MONITORING WELLS	Radiochemicals	3		2	66%
	Fluoride	7		1	14%
	Metals/metalloids	7		0	0%
	Nitrate	7		0	0%
	VOCs + SVOCs*	4	0	0	0%
	Pesticides	4	0	0	0%

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
11	3	4	3	1

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
14	11	3	0

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.

*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

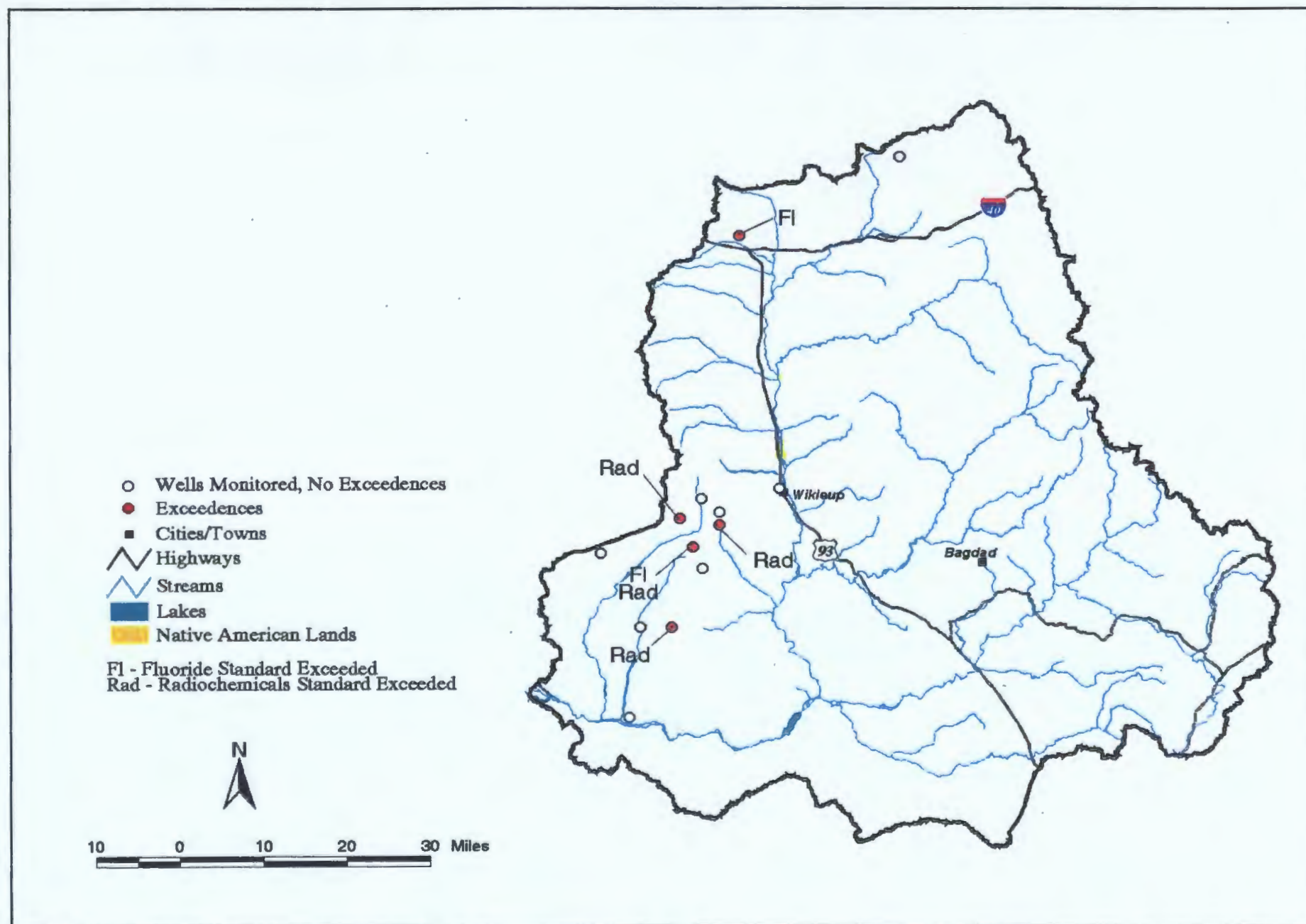


Figure 6. Ground Water Monitoring in the Bill Williams Watershed – 1996-2000

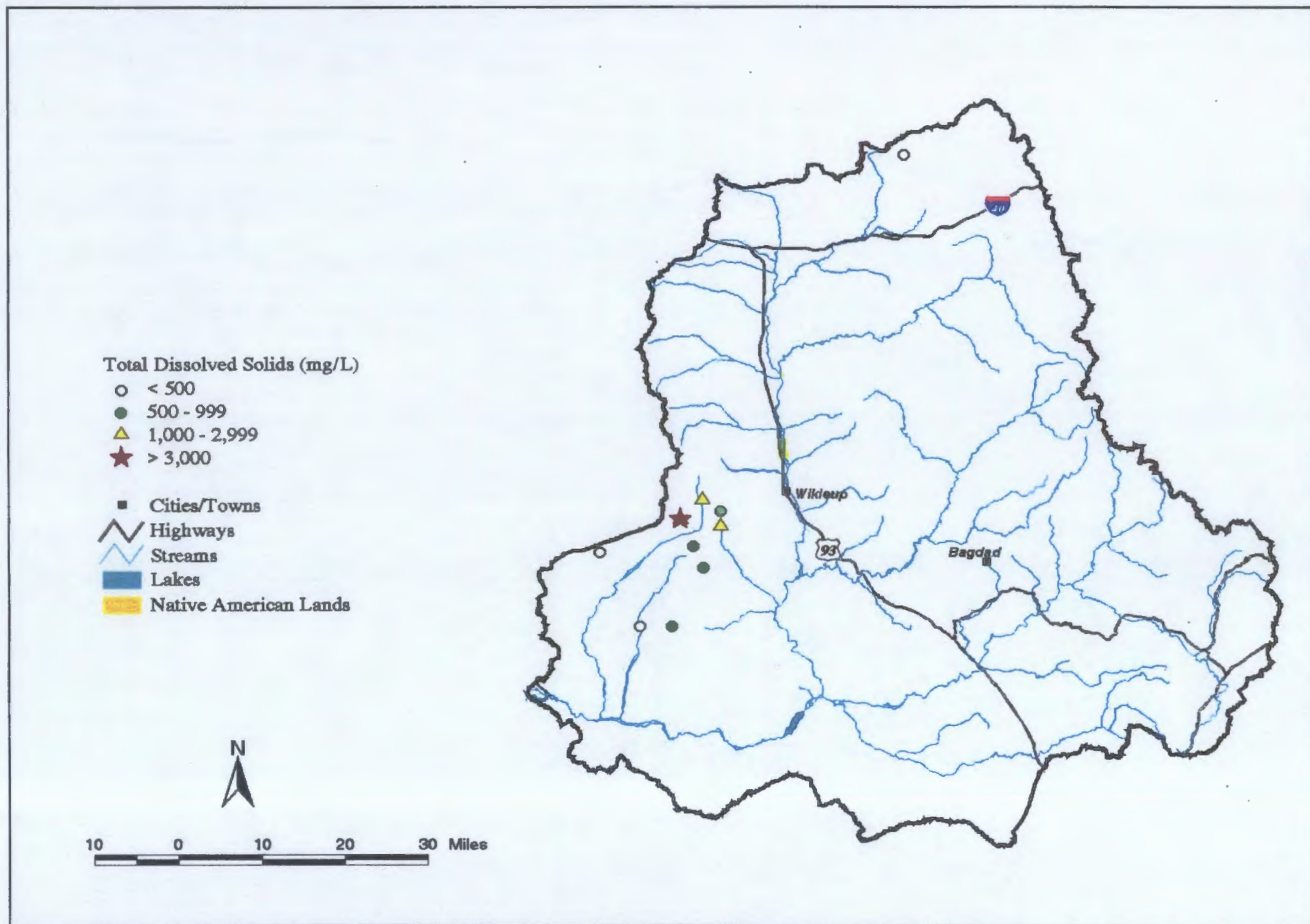


Figure 7. Classification of Ground Water by TDS Concentrations – Bill Williams Watershed

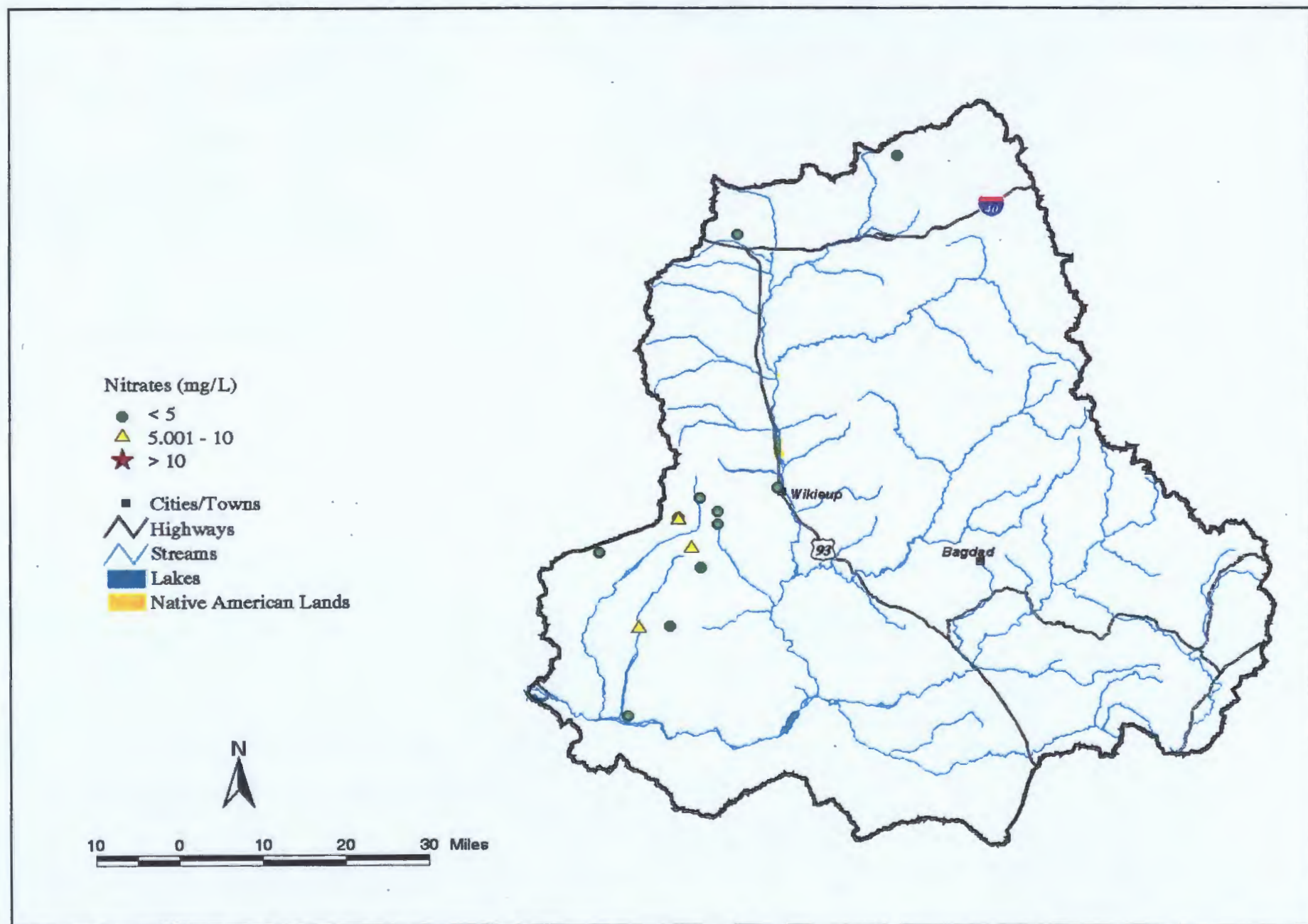


Figure 8. Classification of Ground Water by Nitrate Concentration – Bill Williams Watershed

Watershed Studies and Alternative Solutions in the Bill Williams Watershed

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Bill Williams Watershed. Watershed partnerships active in this watershed are also cited.

Surface Water Studies and Mitigation Projects

Alamo Lake Dam Impacts on Down Stream Channels and Riparian Vegetation; Response of Saplings of Three Riparian Species in Bill Williams River, Arizona – This study looked at the impacts of a dam on the indigenous, pioneer vegetation and stream channels along the Bill Williams River, compared to the Santa Maria River (Shafroth, 1999). With the establishment of three woody riparian species along the Bill Williams River this study finds:

- ▶ Stream patterns -- the flood magnitude has been reduced, low flows have increased, the channels have narrowed;
- ▶ Ground water patterns -- maximum depth and maximum flow rate of ground water declined;
- ▶ Vegetation patterns -- 92-100% of the populus and salix saplings died, while 1-13% of the Tamarisk stems died. 92-100% of the populus and salix saplings died, while 1-13% of the Tamarisk stems died). This resulted in the flood plain contained more patches dominated by salt cedar (*Tamarix ramosissima*), woody vegetation was denser, and mature vegetation declined.

These results show that plant response is dependent on the roots relative to the ground water change, soil texture and stratigraphy, precipitation, adaptations to stress, and tree age.

Total Maximum Daily Load Studies – The following TMDL analysis has been initiated in this watershed. Further information about the status of this or other TMDL investigations can be obtained by contacting the TMDL Program manager Nancy LaMascus at (602) 771-4468 or at ADEQ's web site: <http://www.adeq.state.az.us/envirom/water/assess/tmdl.html>

- **Boulder Creek TMDL Study** – Boulder Creek is a 37 mile long, primarily ephemeral stream that flows into Burro Creek. An 8.5 miles

reach (from Wilder Creek to its confluence with Burro Creek) is listed as impaired due to metals. Hillside Mine, an abandoned gold-silver-zinc-lead mine and mill site located alongside Boulder Creek has been the principal source of concern, although other abandoned mines further upstream are also being investigated.

Preliminary findings indicate that material from the tailings pile and a seep at the site are significantly impacting water quality of Boulder Creek. The seep emanates from a collapsed adit, and flows at approximately five gallons per minute. The seep which is high in arsenic, copper, manganese, and zinc is the only contributing source of flow for Boulder Creek during dry periods. Most of the metals dissipate in the reach by Butte Creek, except for arsenic which extends down to Butte Creek.

Water Protection Fund Projects – The following Water Protection Fund projects are in the Bill Williams watershed:

- **Kirkland Creek (Sub-)Watershed Resource Assessment** -- The Triangle Natural Resources Conservation District was funded to conduct a thorough resource assessment of Kirkland Creek. Project personnel will use the information to prepare a long-term action plan, including an implementation schedule for watershed enhancement activities. In addition, project personnel will assist ranches with updating resource management plans. This project has a strong community outreach component, which includes newsletters and public meeting to keep local residents informed and promote community input. To be completed in 2003.
- **Coconino Plateau Regional Water Study** -- The City of Williams is contracting with the U.S. Geological Survey to determine the physical boundaries and flow direction for the systems that supply the major springs of the Coconino Plateau in the Greater Grand Canyon region. The project will examine the geohydrologic controls and provide the basic data needed to estimate impacts of development on the springs and riparian habitats, through well and spring inventories. The application also proposes to determine additional data needs and analysis required to evaluate the sustainability of natural flows, and will

develop a monitoring plan for future collection of baseline data. This project is to be completed in 2002.

- Big Sandy River Riparian Project -- The Bureau of Land Management received funds to restore an 8-mile perennial reach along the Big Sandy River south of the Kingman Resource Area near Alamo Lake. Under this grant, pasture fencing was constructed to help control livestock. Additionally, the development of upland livestock water sources will facilitate the management of livestock. This project was completed in 2000.
- Riparian Vegetation and Stream Channel Changes Associated with Water Management along the Bill Williams River -- Arizona State University received funds to produce quantitative data on the relationship between stream flow and historic changes in the riparian community and channel morphology along Bill Williams River below Alamo Dam. This information will be used in an ongoing effort to define reservoir operation regimes that will ensure protection of the riparian habitat downstream of Alamo Dam. The project was completed in 1999.

Ground Water Studies and Mitigation Projects

Ground water Reconnaissance Survey in Mohave County: The watersheds (Sacramento Valley, Big Sandy Valley, Detrital Valley and Hualapai Valley) are all to the south of the Colorado River -- (See discussion in the Colorado Grand Canyon Watershed.)

Watershed Partnerships

Upper Bill Williams Watershed Partnership -- This partnership's concern has been focused on water quality in Alamo Lake, a recreational magnet for this watershed, and nearby Boulder Creek with its potential for contamination due to historic resource extraction. Recently, the partnership proposed a Phase I Planning Study to develop a water resource plan that would identify key waterbody stressors and potential projects that might qualify for Water Quality Improvement Grants or Water Protection Grants.

Colorado-Grand Canyon Watershed



Colorado-Grand Canyon Watershed

CG - 1

COLORADO-GRAND CANYON WATERSHED CHARACTERISTICS

SIZE	16,437 square miles (14% of the State's land area).					
POPULATION BASE	Approximately 67,500 people live in this watershed (estimated from the 2000 census). This is about 1.5% of the state's population.					
LAND OWNERSHIP (Figure 9)	Bureau of Land Management	32%	Tribal land	22%	National Parks and Monuments	15%
	Private land	13%	U.S. Forest Service	10%	State Land Dept.	8%
LAND USES AND PERMITS (Figure 10)	Most of this watershed is sparsely populated. The largest communities are Kingman and Williams. Land use is primarily a mixture of open grazing, recreation, and silviculture, with scattered mineral districts. This watershed contains the Grand Canyon National Monument, Kaibab National Forest, and Lake Mead and Glen Canyon national recreational areas which all have restricted land uses to protect natural resources. These federal lands also draw a large number of tourists and recreationists.					
HYDROLOGY AND GEOLOGY	<p>This watershed is defined by the Colorado River drainage area within Arizona from Lake Powell to Hoover Dam at Lake Mead, excluding the Little Colorado River drainage through the Grand Canyon National Monument. The Colorado River and many of its tributaries (near their confluence with the Colorado River) are perennial; however, most of the streams in the watershed are ephemeral or intermittent (Brown et al. 1978). The flow in the Colorado River at Lee's Ferry has an average discharge of 17,850 cfs, with a maximum discharge of 97,300 cfs (in 1983). Prior to completion of Glen Canyon Dam in 1963 the maximum flow was about 300,000 cfs (since 1868) (USGS 1996).</p> <p>Several ground water basins are included in this watershed, including: the Coconino Plateau, Detrital Valley, Grand Wash, Hualapai Valley, Kanab Plateau, Meadview, Paria, Peach Springs, Shivwits Plateau, and Virgin River basins, along with minor portions of Big Sandy, Lake Mohave, and the Little Colorado River basins Verde Watershed. The area contains incised canyons formed by erosion of sedimentary formations, volcanically formed mountains, and high plateaus, valleys, and mountain canyons. Aquifers with low water-yields are contained in fractured limestones, sandstones, shales, and igneous rocks. High water-yield aquifers are typically found in alluvium and basin fill deposits in valleys and along rivers. (ADWR 1994)</p> <p>Elevations range from 1,000 feet above sea level along the Colorado River to 12,600 feet at the San Francisco Peaks. Most of the watershed is included in the Plateau Uplands Province (upper elevations), with a portion of the Basin and Range Province (lower elevations)</p>					
UNIQUE WATERS	None					
ECOREGIONS	Primarily the Arizona-New Mexico Plateau, with Arizona-New Mexico Mountains on the eastern edge and Southern Basin and Range on the western edge .					
OTHER STATES, NATIONS, TRIBES	This watershed receives drainage from Utah, Colorado, Wyoming, and New Mexico to the north and Nevada to the west. It discharges to the Colorado-Lower Gila Watershed to the south. Hualapai, Havasupai, Kaibab-Paiute, and Navajo tribal lands occur within this watershed.					

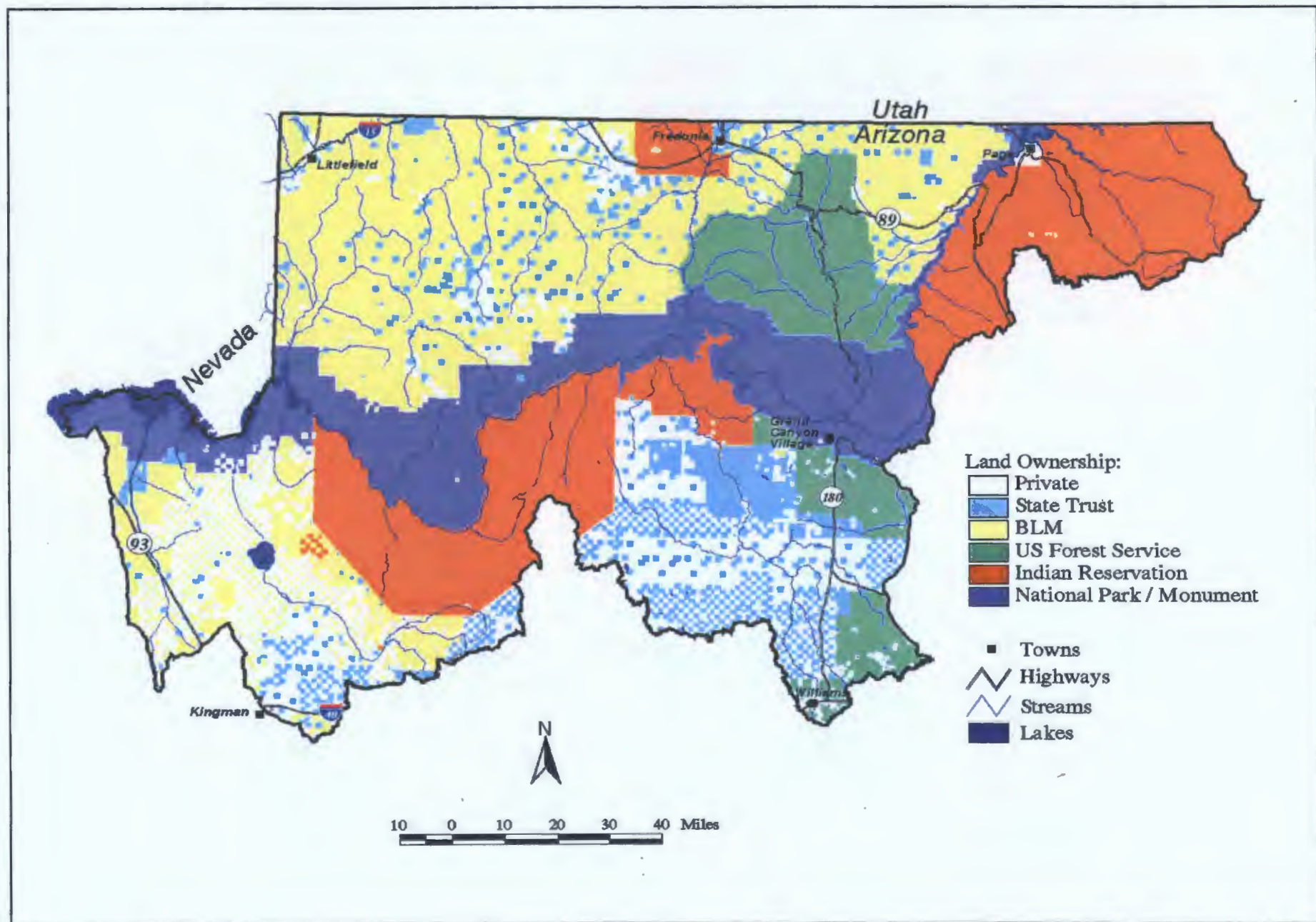


Figure 9. Land Ownership in the Colorado-Grand Canyon Watershed

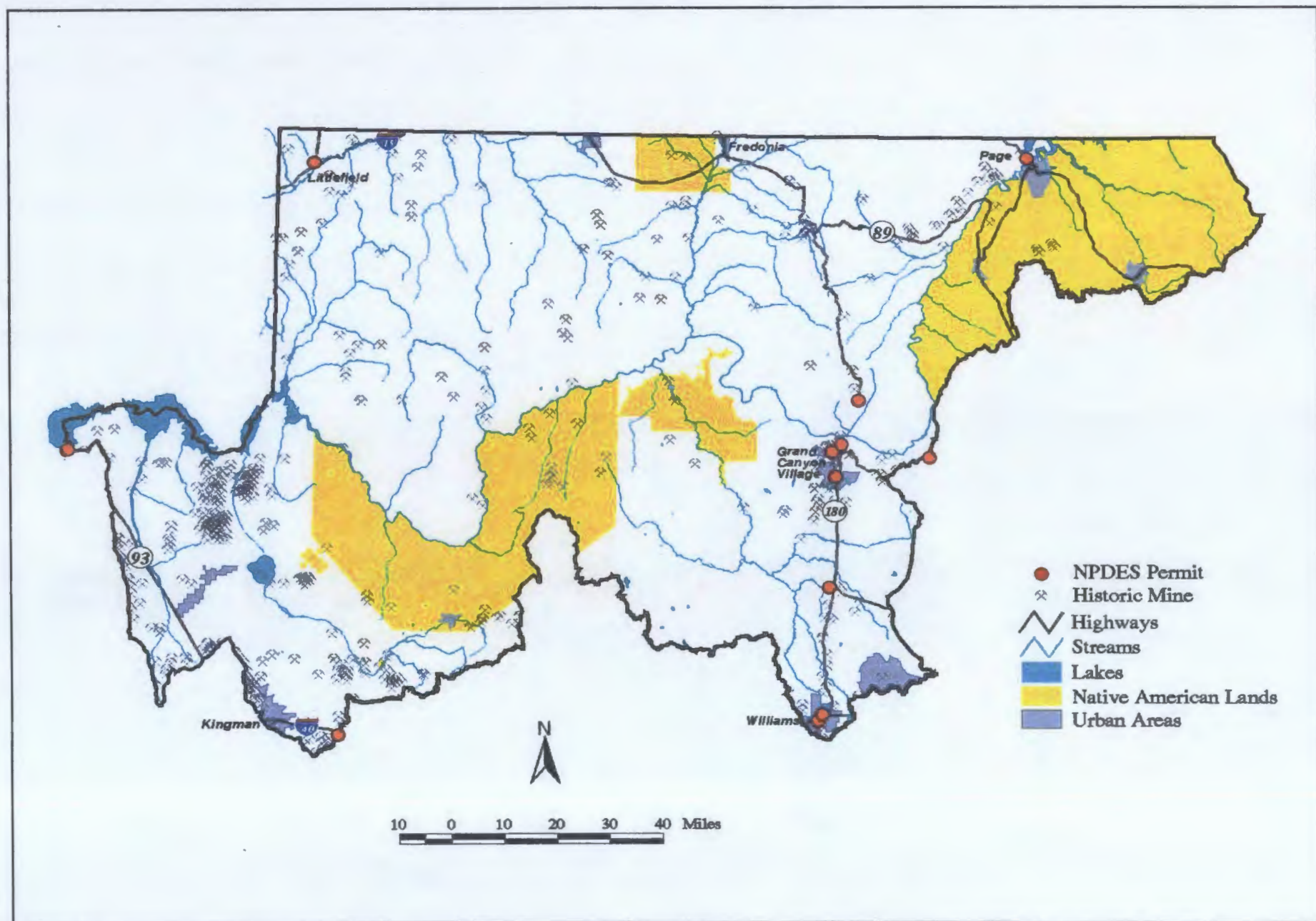


Figure 10. General Land Use and NPDES Permits in the Colorado-Grand Canyon Watershed

Colorado-Grand Canyon Watershed Assessment Discussion

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 94 stream miles and 9,770 lake acres were assessed. Fewer assessments were completed than previously because of two factors: 1) changes in assessment criteria requiring more data to base an assessment and documented sampling analysis plans, and 2) a lack of current credible water quality data. This watershed will be a focus for additional monitoring in 2004.

Water quality assessment information for the Colorado-Grand Canyon Watershed is summarized in the following tables and illustrated in **Figure 11**.

Table 6. Assessments in the Colorado-Grand Canyon Watershed – 2002

	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	46	2	0	0
INCONCLUSIVE	10	1	9,770	1
IMPAIRED	38	2	0	0
NOT ATTAINING			0	0
TOTAL ASSESSED	94	5	9,770	1

PERENNIAL SURFACE WATERS ASSESSED		STREAMS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	84	4	9,770	1

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial mileage although part of the reach may have ephemeral or intermittent flow.

Inconclusive Assessments – Surface waters with some monitoring data but insufficient data to determine if the water is attaining its uses or impaired were added to ADEQ's new Planning List. By the end of the focused watershed monitoring (scheduled in 2004), ADEQ expects to monitor most of these reaches

so they can be assessed during future assessment cycles. Other lakes and streams which lack water quality data will also be monitored depending on resources and priorities.

As indicated in the monitoring data table that follows, the data acquired from the National Park Service did not meet new credible data requirements for these surface water assessments because a Quality Assurance Plan and Sampling Analysis Plan were not available. The data also did not include a significant number of core parameters, so that even if the data had been used, no designated uses could have been assessed as attaining uses. There were also insufficient samples to determine if the water was impaired if there were any standards exceeded. ADEQ will be coordinating with this agency to encourage additional monitoring documentation needed to meet Arizona's new requirements for all future monitoring.

Major Stressors – When a surface water is listed as impaired or TMDL approved, the pollutants or suspected pollutants causing the impairment are identified. Only two reaches are to be listed as impaired in this watershed. One reach along the Virgin River and one along the Colorado River. Both were impaired by turbidity. The Virgin River was also impaired by fecal coliform.

TMDL investigations are needed to determine the sources of these pollutants and the extent that natural background contributes to these exceedances.

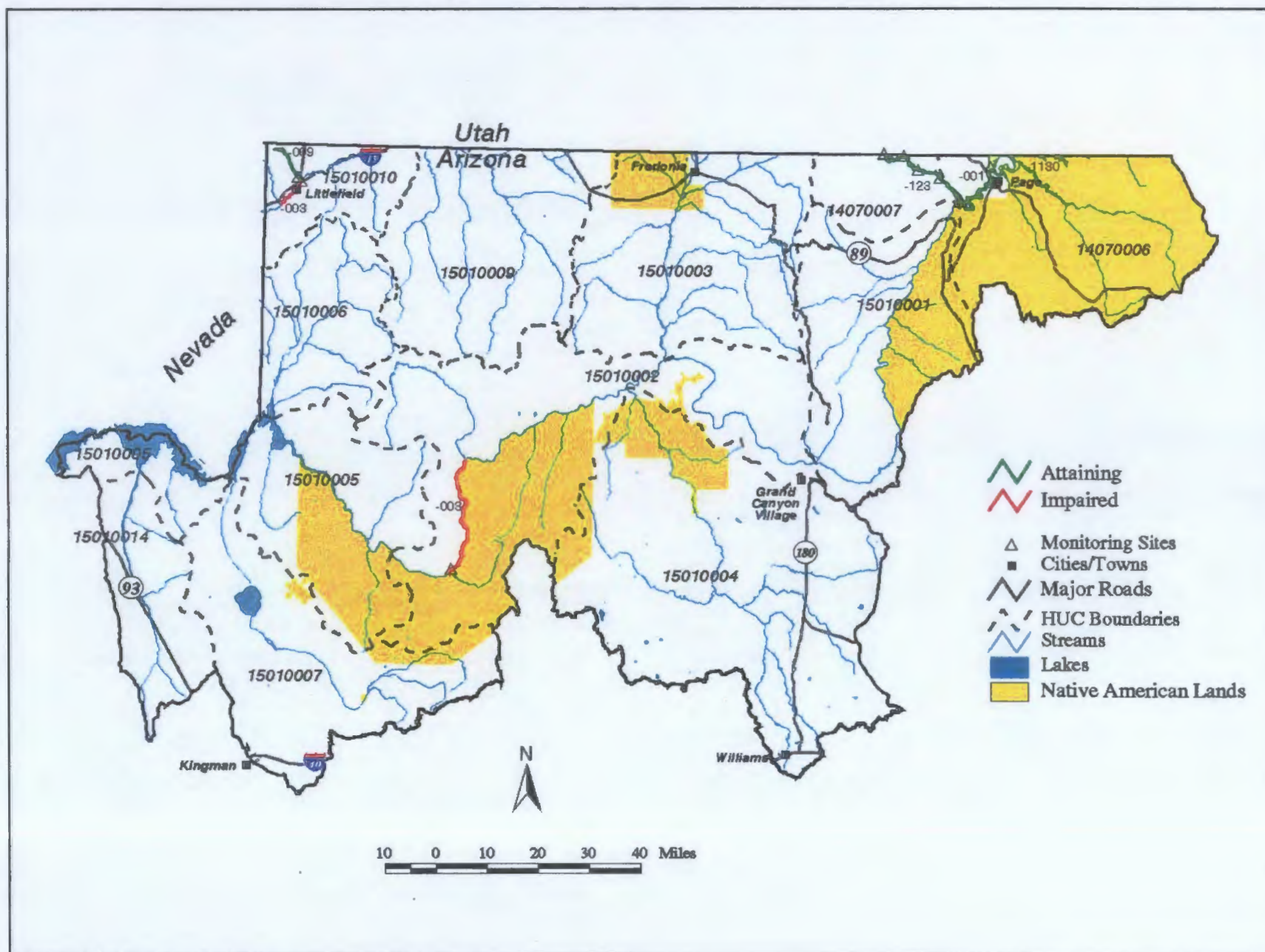


Figure 11. Colorado-Grand Canyon Watershed 2002 Assessments

TABLE 7. COLORADO - GRAND CANYON WATERSHED - 2002 ASSESSMENT - MONITORING DATA TABLE

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	PARAMETRIC USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Beaver Dam Wash, Utah border-Virgin River AZ15010010-009 A&Ww, FC, FBC, Agl, AgL	ADEQ Fixed Station Network Above Virgin River CMBDW000.08 100452	1997 - 1 suite	OK					
	ADEQ Fixed Station Network Below R. Lyon's Property CMBDW000.49 100451	1997 - 1 suite	OK					
	ADEQ Fixed Station Network Below Hwy 91 bridge CMBDW000.73 100449	1997 - 1 suite	OK					
	ADEQ Fixed Station Network At right bank spring CMBDW000.913 100446	1997 - 1 suite	Dissolved oxygen mg/L	6.0 90% saturation (A&Ww)	5.8 (55%)	1 of 1		Field staff documented that naturally occurring ground water upwelling from spring sources, rather than any anthropogenic activities, caused the low dissolved oxygen; therefore, not considered in the final assessment.
	ADEQ Fixed Station Network At left bank spring CMBDW000.918 100448	1997 - 1 suite	Dissolved oxygen mg/L	6.0 90% saturation (A&Ww)	5.8 (45%)	1 of 1		
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	1997 5 samples 1 sampling event	OK				Inconclusive	ADEQ collected a total of 5 samples at 5 sites during 1 sampling event in 1997. Assessed as "inconclusive" as a minimum of 3 sampling events are needed to as "attaining" uses.
Boucher Creek California-Colorado River AZ15010002-017 A&Wc, FC, FBC	National Park Service Routine Monitoring Below camp, near Tonto Trail CMBOU000.67	1997 - 1 field 1998 - 1 field	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and insufficient sampling events to support assessments.
	Reach Summary Row		OK				Not assessed	Insufficient credible data.

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Chuar (Lava) Creek headwater-Colorado River AZ15010001-024 A&Wc, FC, FBC	National Park Service Routine Monitoring Near Colorado River (Lava Cyn) CMCHU000.22	1996 - 1 field 1998 - 1 field	Turbidity NTU	10 (A&Wc)	165-884	2 of 2		Turbidity determined to be due to erosion of natural sandstone formations rather than human caused. National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Clear Creek headwaters-Colorado River AZ15010001-025 A&Wc, FC, FBC	National Park Service Routine Monitoring At confluence with Colorado River CMCLE000.03	1996 - 1 field 1997 - 1 field 1998 - 1 field	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Colorado River Lake Powell-Paria River AZ14070006-001 A&Wc, FC, FBC, DWS, Agl, AgL	USGS Station #09379910 Below Glen Canyon Dam CMCLR333.55	1997 - 2 suites	OK					Missing core parameters
	USGS Station #09380000 At Lee's Ferry CMCLR327.39 100743	1996 - 10 suites 1997 - 4 suites 1998 - 6 suites 1999 - 6 suites 2000 - 7 suites	OK					
	Bureau of Reclamation and /Utah Dept. of Env. Quality Lake Powell Monitoring Below Glen Canyon Dam CMCLR333.61	1996-1998 - 33 suites	OK					Limited parameters (no metals)
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining Agl Attaining AgL Attaining	1996-2000 68 sampling events	OK				Attaining	US Geological Survey, Bureau of Reclamation and the Utah DEQ collected a total of 68 samples at 3 sites in 1996-2000. The reach is assessed as "attaining all uses."
Colorado River Parashant-Diamond AZ15010002-003 A&Wc, FC, FBC, DWS, Agl, AgL	USGS Station #09404200 Above Diamond Creek CMCLR233.40 100751	1997 - 9 suite 1998 - 8 suite 1999 - 9 suite 2000 - 5 suite	Turbidity NTU	10 (A&Wc)	1.3-1000	15 of 32		Missing core parameters: total mercury, arsenic, beryllium, manganese, boron, copper, and lead, and Escherichia coli.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	PARAMETRIC USE SUPPORT	COMMENTS
	Reach Summary Row A&Ww Impaired FC Inconclusive FBC Inconclusive DWS Inconclusive Agl Inconclusive AgL Inconclusive	1997-2000 31 sampling events Missing core parameters	Turbidity NTU	10 (A&Wc)	1.3-1000	15 of 32	Impaired	US Geological Survey monitoring at one site for a total of 31 sampling events. Reach is assessed as "impaired" due to turbidity. Reach also added to the Planning List due to insufficient core parameters.
Cottonwood Creek headwaters-Colorado River AZ15010001-026 A&Ww, FC, FBC, AgL	National Park Service Routine Monitoring At Gage (and spring) CMCOT000.76	1997 - 1 pH	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Crystal Creek headwaters-Colorado River AZ15010002-018 A&Wc, FC, FBC	National Park Service Bioassessment Program Above Colorado River CMCRY000.05	1996 - 1 field 1997 - 1 field 1998 - 1 field, 1 bact 1999 - 1 field	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data..
Deer Creek headwaters-Colorado River AZ15010002-019 A&Wc, FC, FBC	National Park Service Bioassessment Program At Colorado River CMDEE000.03	1996 - 2 field 1997 - 1 field 1998 - 2 field	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data. .
Garden Creek headwaters-Colorado River AZ15010002-841 A&Wc, FC, FBC	National Park Service Routine Monitoring Below Tonto Trail/ Indian Garden CMGDN001.12	1997 - 1 field 1998 - 1 field, 1 bact	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Hermit Creek headwaters-Colorado River AZ15010002-020 A&Wc, FC, FBC	National Park Service Bioassessment Program Above Colorado River CMHRM000.05	1996 - 1 field 1997 - 1 field 1998 - 1 field						National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.

TABLE 7. COLORADO - GRAND CANYON WATERSHED - 2002 ASSESSMENT - MONITORING DATA TABLE

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	PARAMETRIC USE SUPPORT	COMMENTS
Kanab Creek Jump-up Canyon-Colorado River AZ15010003-001 A&Ww, FC, FBC, DWS, AgL	National Park Service Bioassessment Program Above Colorado River CMKAN000.20	1996 - 1 field	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Kwagunt Creek headwaters-Colorado River AZ15010001-031 A&Wc, FC, FBC	National Park Service Routine Monitoring By Mesquite near Colorado River CMKWA000.17	1996 - 2 field 1997 - 1 field 1998 - 1 field	Turbidity NTU	10 (A&Wc)	0.65-113	1 of 4		Turbidity is due to natural erosion of sandstone formations in the Grand Canyon rather than human-caused sources. National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Monument Creek headwaters-Colorado River AZ15010002-845 A&Ww, FC, FBC	National Park Service Routine Monitoring At Colorado River CMMON000.08	1996 - 1 field 1997 - 1 field 1998 - 1 field	Dissolved oxygen mg/L	6.0 90% saturation (A&Ww)	3.5-8.1 46-96%	1 of 3		Field staff documented that naturally occurring ground water upwelling rather than any anthropogenic activities caused the low dissolved oxygen; therefore, data not considered in the final assessment.. National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Nankoweap Creek headwaters-Colorado River AZ15010001-033 A&Wc, FC, FBC	National Park Service Routine monitoring Above Confluence CMNAN000.09	1998 - 2 field 1997 - 1 field 1998 - 2 field	Turbidity NTU	10 (A&Wc)	65.6	1 of 5		National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
National Canyon Creek headwaters-Colorado River AZ15010002-016 A&Wc, FC, FBC	National Park Service Routine monitoring Above Colorado River CMNAT000.34	1997 - 1 field 1998 - 2 field	Turbidity NTU	10 (A&Wc)	16-24.5	3 of 3		Field staff documented that turbidity is due to naturally occurring erosion of sandstone formations in this pristine drainage area of the Grand Canyon rather than anthropogenic sources; therefore, data were not included in the final assessment.. National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.

TABLE 7. COLORADO - GRAND CANYON WATERSHED - 2002 ASSESSMENT - MONITORING DATA TABLE

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	PARAMETRIC USE SUPPORT	
Paria River Utah-Colorado River AZ14070007-123 A&Wc, FC, FBC	ADEQ TMDL Program Site 7 at Lees' Ferry CMPAR000.55 101073	1999 - 4 suite 2000 - 6 suite, 1 metals	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.3-8.2 (0%)	7 of 10		Field staff documented that naturally occurring ground water upwelling (generally flow is from spring sources) rather than any anthropogenic activities caused the low dissolved oxygen; therefore, data not considered in the final assessment.
			Turbidity NTU	10 (A&Wc)	6.8-441	8 of 10		Investigation showed that high turbidity is solely due to natural erosion of sandstone cliffs. Data not used in final assessment.
	Northern Arizona University Paria TMDL Monitoring Site 5 - 25 km below Buckskin G. Site 6 - 37.5 km below Buckskin G. Site 7 - 50 km below Buckskin G. Part of Seven sites along the Paria River and Buckskin Gulch,	1999 - 4 field, dissolved metals - each site 2000 - 6 field, dissolved metals - each site	Beryllium µg/L	0.21 (FC) 4.0 (FBC)	<0.1 - 17.3	21 of 30 3 of 30		Metals data did not meet credible data requirements due to lapses in quality control/ protocols (testing after holding times expired).
			Dissolved oxygen mg/L	7.0 (A&Wc)	4.0 - 10.7	14 of 30		Investigation shows that low dissolved oxygen and high turbidity are solely due to natural conditions (see comment at first site).
			Turbidity NTU	10 (A&Wc)	6 - 441	23 of 30		
	ADEQ TMDL Program Site 6 at mile marker 22.5 CMPAR007.95 101074	1999 - 4 suite 2000 - 6 suite, 1 metals	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.3-9.1 (0%)	4 of 10		Investigation shows that low dissolved oxygen and high turbidity are solely due to natural conditions (see comment at first site).
			Turbidity NTU	10 (A&Wc)	6.2-441	8 of 10		
	ADEQ TMDL Program Site 5 at mile marker 15 CMPAR013.79 101075	1999 - 4 suite 2000 - 6 suite, 2 metals	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4-10.7 (0%)	3 of 10		Investigation shows that low dissolved oxygen and high turbidity are solely due to natural conditions (see comment at first site).
			Turbidity NTU	10 (A&Wc)	6.0-441	8 of 10		
	ADEQ TMDL Program Site 4 at mile marker 7.5 CMPAR022.37 101076	1999 - 4 suite 2000 - 6 suite, 1 metals	Arsenic µg/L	360 (A&Wc) 50 (FBC)	2-425	1 of 11 1 of 11		
			Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.8-10.6 (0%)	6 of 10		Investigation shows that low dissolved oxygen and high turbidity are solely due to natural conditions (see comment at first site).
			Turbidity NTU	10 (A&Wc)	4.2-441	8 of 10		

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	PARAMETRIC USE SUPPORT	
	ADEQ TMDL Program Site 3 below confluence CMPAR029.87 101077	1999 - 4 suite 2000 - 6 suite, 1 metals	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.3-9.1 (0%)	3 of 9		Investigation shows that low dissolved oxygen and high turbidity are solely due to natural conditions (see comment at first site).
			Turbidity NTU	10 (A&Wc)	6.2-441	7 of 10		
			Arsenic µg/L	50 (FBC)	<2-96.3	1 of 10		
			pH SU	6.5-9.0 (A&Wc, FBC)	8/04-9.32	1 of 9		
	ADEQ TMDL Program Site 2 above Colorado River CMPAR029.90 101078	1999 - 4 suite 2000 - 6 suite, 1 metals	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	3.9-14.8 (0%)	3 of 10		Investigation shows that low dissolved oxygen and high turbidity are solely due to natural conditions (see comment at first site).
			Turbidity NTU	10 (A&Wc)	0.8-441	6 of 10		
			Arsenic µg/L	50 (FBC)	<2-76.7	2 of 11		
	ADEQ TMDL Program Site 1 Buckskin Gulch CMPAR030.00 101079	1999 - 4 suite 2000 - 6 suite, 1 metals	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.4-9.4 (0%)	1 of 10		Investigation shows that low dissolved oxygen and high turbidity are solely due to natural conditions (see comment at first site).
			Turbidity NTU	10 (A&Wc)	0.9-34	2 of 10		
			Arsenic µg/L	50 (FBC)	<2-129.5	3 of 10		
	Northern Arizona University Paria TMDL Monitoring Site 2 - 10 meters above Buckskin Site 3 - 10 meters below Buckskin Site 4 - 12.5 m below Buckskin G. Part of Seven sites along the Paria River and Buckskin Gulch,	1999 - 4 field, dissolved metals – each site 2000 - 6 field, dissolved metals - each site	Arsenic µg/L	50 (FBC)	<2.0 - 457.7	2 of 30		Metals data did not meet credible data requirements due to lapses in quality control/ protocols (testing after holding times expired). Naturally occurring low dissolved oxygen (see notes in first site). Data not used in final assessment.
			Beryllium µg/L	0.21 (FC) 4.0 (FBC)	<0.1 - 38.4	22 of 30 7 of 30		
			Dissolved oxygen mg/L	7.0 (A&Wc)	4.8 - 10.6	12 of 30		
			Turbidity NTU	10 (A&Wc)	0.8 - 441	21 of 30		
	Reach Summary Row A&Wc Attaining FC Attaining FBC Attaining	1999-2000 82 samples 7 sampling events	Arsenic µg/L	360 (A&Wc) 50 (FBC)	<2-457.7	1 of 75 6 of 75	Attaining Attaining	ADEQ's TMDL Program collected samples at 7 sites. Reach assessed as "attaining all uses." Note that low dissolved oxygen levels and high turbidity were found to be solely due to natural sources.
			pH SU	6.5-9.0 (A&Wc, FBC)	8/04-9.32	1 of 70	Attaining	

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	PARAMETRIC USE SUPPORT	COMMENTS
Pumpkin Springs At Colorado River AZ15010002-SP01 A&Ww, FC, FBC, DWS, AgL, AgL	National Park Service Routine Monitoring Above Colorado River CMSPR3	1998 - 1 field	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Royal Arch Creek headwaters-Colorado River AZ15010002-871 A&Wc, FC, FBC	National Park Service Routine monitoring Above Colorado River CMRYA000.23	1996 - 2 field 1997 - 1 field 1998 - 1 field 1999 - 1 field	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Saddle Canyon Creek headwaters-Colorado River AZ15010002-703 A&Wc, FC, FBC	National Park Service Routine Monitoring Near Tapeats, below falls CMSAD000.16	1996 - 1 field 1997 - 1 field 1998 - 1 field 1999 - 1 field	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Shinumo Creek headwaters-Colorado River AZ15010002-029 A&Wc, FC, FBC	National Park Service Routine Monitoring Colorado River, @ Trail crossing CMSHI000.06	1996-- 1 field 1997 - 1 field 1998 - 1 field	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Spring Canyon Creek headwaters-Colorado River AZ15010002-318 A&Wc, FC, FBC	National Park Service Routine monitoring Above Colorado River CMSPG000.24	1996 - 1 field 1997 - 1 field 1998 - 1 field 1999 - 1 field	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Stone Creek headwaters-Colorado River AZ15010002-030 A&Wc, FC, FBC	National Park Service Routine Monitoring At Colorado River, below falls CMSTO000.14	1997 - 1 field	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Tapeats Creek headwaters-Colorado River AZ15010002-696 A&Wc, FC, FBC	National Park Service Routine monitoring Above Colorado River CMTAP000.24	1996 - 1 field 1998 - 1 field	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	PARAMETRIC USE SUPPORT	COMMENTS
Three Springs Creek headwaters-Colorado River AZ15010002-1180 A&Wc, FC, FBC, DWS, Agl, AgL	National Park Service Routine monitoring Above Colorado River CMTHS000.04	1996 - 1 field 1997 - 1 field 1998 - 1 field	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Thunder River headwaters-Tapeats Creek AZ15010002-732 A&Wc, FC, FBC	National Park Service Routine Monitoring Below Cave, @ Tapeats CMTHR000.38	1999 - 1 field	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Vasey's Paradise (Spring) At Colorado River AZ15010001-SP01 A&Wc, FC, FBC	National Park Service Routine Monitoring Below Spring CMSPR1	1996 - 2 field 1997 - 1 field 1998 - 1 field 1999 - 1 field	OK					National Park Service data did not meet new "credible data" requirements. Also insufficient core parameters and sampling events for assessments.
	Reach Summary Row						Not assessed	Insufficient credible data.
Virgin River Beaver Dam Wash-Big Bend W. AZ15010010-003 A&Ww, FC, FBC, Agl, AgL	USGS Station # 9415000 At Littlefield, Az CMVGR010.18	1996 - 5 suite	Fecal coliform CFU/100/ml	4000 (A&Ww, Agl, AgL)	19-240,000	2 of 15		2 exceedances occurred in a 3-year period.
		1997 - 6 suite						
		1998 - 6 suite	Escherichia coli CFU/100/ml	580 (FBC)	12-3000	1 of 5		Not sampled for E. coli in 1996-1998.
		1999 - 8 suite						
		Missing total mercury, arsenic, beryllium manganese, boron, and copper.	Turbidity NTU	50 (A&Ww)	0.3-360	8 of 23		Naturally occurring erosion of sandstone formations may be the cause of turbidity.
	Reach Summary Row	1996-1999 23 samples Missing core parameters	Escherichia coli CFU/100/ml	580 (FBC)	12-3000	1 of 5	Inconclusive	US Geological Service collected 23 samples in 1996-1999. Reach assessed as impaired due to turbidity and bacteria. Reach put on Planning List due to missing core parameters.
	A&Ww FC FBC Agl Agl	Impaired Inconclusive Inconclusive Impaired Impaired	Fecal coliform CFU/100 ml	4000 (A&Ww, Agl, AgL)	19-240,000	2 of 15 2 in 3-years	Impaired	
			Turbidity NTU	50 (A&Ww)	0.3-360	8 of 23	Impaired	
LAKES MONITORING DATA								
Lake Powell AZL14070006-1130 A&Wc, FC, FBC, DWS, Agl, AgL	Bureau of Rec. Selenium Investigation 4 sites CMPOW	1996 - 4 selenium 1997 - 1 selenium 1998 - 3 selenium 1999 - 3 selenium	OK					Exceeds chronic selenium standard occasionally (12 of 49 samples). Median did not exceed chronic standard.
	Glen Canyon Natl. Rec. Area Bact Monitoring Network CMPOW - AP2	1995 - 17 bact 1996 - 16 bact 1997 - 9 bact 1998 - 10 bact	OK					

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	PARAMETRIC USE SUPPORT	COMMENTS
	Glen Canyon Natl. Rec. Area Bact Monitoring Network CMPOW - NPS1	1996 - 12 bact	OK					
	Glen Canyon Natl. Rec. Area Bact Monitoring Network CMPOW - STATE1	1996 - 12 bact 1997 - 8 bact 1998 - 10 bact 1999 - 8 bact	OK					
	Glen Canyon Natl. Rec. Area Bact Monitoring Network CMPOW - WWB1	1996 - 16 bact 1997 - 10 bact 1998 - 10 bact 1 1999 - 10 bact	OK					
	Glen Canyon Natl. Rec. Area Bact Monitoring Network CMPOW - WWM1	1998 - 10 bact 1999 - 10 bact	OK					
	Glen Canyon Natl. Rec. Area Bact Monitoring Network CMPOW - WWPB1	1996 - 27 bact 1997 - 9 bact 1998 - 10 bact 1999 - 8 bact	OK					
	Glen Canyon Natl. Rec. Area Bact Monitoring Network CMPOW - WWPB2	1996 - 9 bact	OK					
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive Agl Inconclusive AgL Inconclusive	1996-1997 68 sampling events Missing core parameters.	OK				Inconclusive	Bureau of Recreation and Glen Canyon Natural Recreation Area collected a total of 68 samples at 11 sites on Lake Powell in Arizona. Insufficient core parameters monitored to assess uses.

Information for interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from combining the following: AZ (for streams) or AZL (for lakes) + a US Geological Survey Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses," "Agency," and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year" is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
 - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among the many monitoring entities that provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
 - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
 - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."
 - Although many parameters may be analyzed, only those exceeding a standard are shown. Other parameters were collected.
 - "OK" indicates that no standards were exceeded.
 - The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
 - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
 - A mean, geometric mean, or median will be shown along with the range of results if applicable to the standard or assessment criteria.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or "Inconclusive." See assessment criteria in Chapter III of Volume I.

Ground Waters Assessments in the Colorado-Grand Canyon Watershed

Major ground water stressors – Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 8** and illustrated in **Figure 12, 13, and 14**. As **Table 8** indicates, wells are sampled for different constituents.

As illustrated in **Figure 12** most of the wells sampled were part of two ADEQ ground water studies: the Virgin River Basin (1999) and the Hualapai Valley Basin (2001). These studies are discussed later in this Section. Note that radiochemical and metals were exceeded in both study areas, while nitrate and fluoride were exceeded only in the Hualapai Valley.

TDS concentration – Water quality can be characterized based on concentration of Total Dissolved Solids (TDS). High levels of salinity limits the practical uses of ground water in some areas of this watershed as TDS over 500 mg/L has an off-flavor (60% of the wells tested) and TDS over 1000 mg/L will limit its use for some crops (33% of the wells tested).

As illustrated in **Figure 13 and Table 8**, TDS is elevated in both ground water basins monitored. There appears to be a cluster of wells along the Virgin River with elevated salinity. The elevated levels of TDS do not present a human-health concern for drinking water use. The TDS concentration is only being used to generally characterize water quality.

Although no TDS ground water quality standard has been established in this watershed, a flow-weighted average annual salinity surface water standard is established on the Colorado River below Hoover Dam, below Parker Dam, and at Imperial Dam, just downstream of this watershed. These standards were established by Arizona as part of the federally administered Colorado River Basin Salinity Control Program, and these standards are being met. More information about the Colorado River Basin Salinity Control Program is provided in Section III of this report.

Nitrate concentrations – Water quality can also be characterized by looking at the concentration of nitrates in ground water (**Figure 14**). Naturally occurring nitrate concentrations in ground water are generally below 3 mg/L. Concentrations above 5 mg/L indicate potential anthropogenic sources of nitrate. Of the 192 wells monitored for nitrate, 15% exceeded this 5 mg/L concentration.

When nitrate concentrations exceed 10 mg/L, Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health, as water with nitrate greater than 10 mg/L may present a health problem for babies and should not be consumed by nursing mothers. Only 2 of the 75 wells monitored (3%) exceeded 10 mg/L. Some monitored wells are irrigation wells (not used for drinking water); therefore, even these two wells may not represent a human-health concern. However, efforts need to continue to minimize further contamination of ground water by nitrate.

Table 8. Colorado-Grand Canyon Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	35		6	17%
	Fluoride	60		2	3%
	Metals/Metalloids	60		7	12%
	Nitrate	60		2	3%
	VOCs + SVOCs*	21	1	0	0%
	Pesticides	21	0	0	0%
TARGETED MONITORING WELLS	Radiochemicals	4		0	0%
	Fluoride	13		0	0%
	Metals/metalloids	14		0	0%
	Nitrate	15		0	0%
	VOCs + SVOCs*	0	---	--	--
	Pesticides	0	---	--	--

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
64	26	17	20	1

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
75	64	9	2

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.

*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

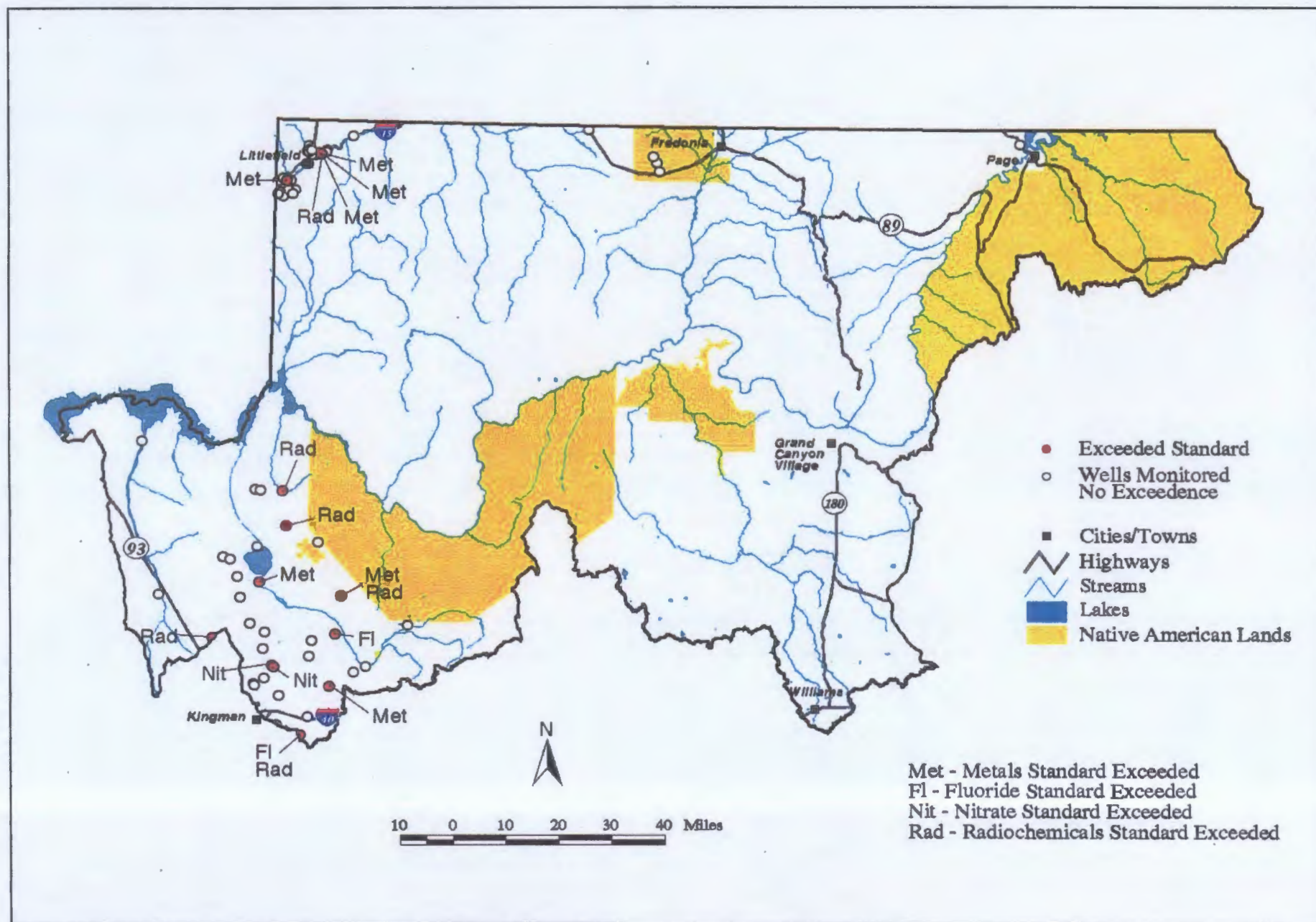


Figure 12. Ground Water Monitoring in the Colorado-Grand Canyon Watershed – 1996-2000

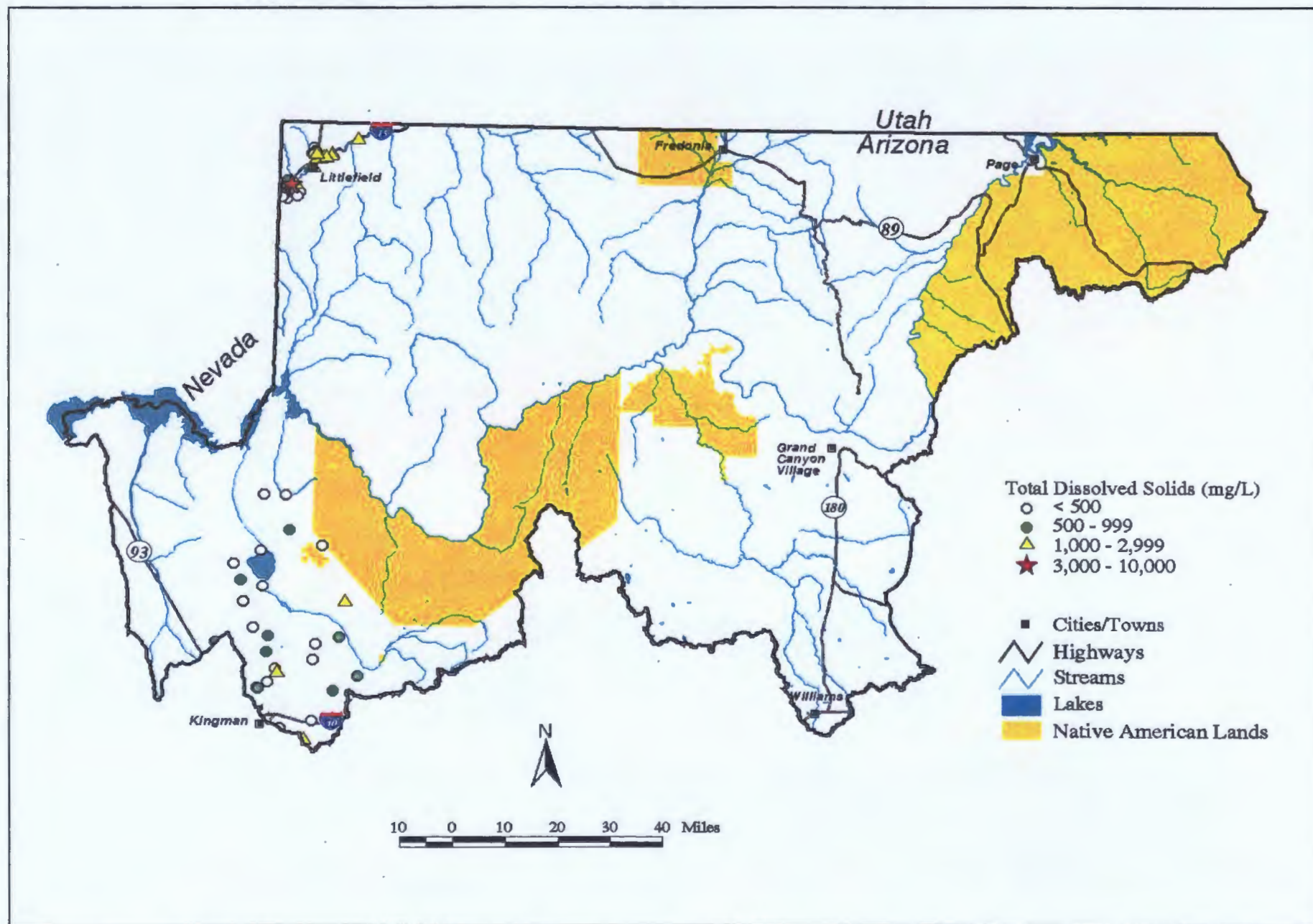


Figure 13. Classification of Ground Water Quality by TDS Concentration in the Colorado-Grand Canyon Watershed

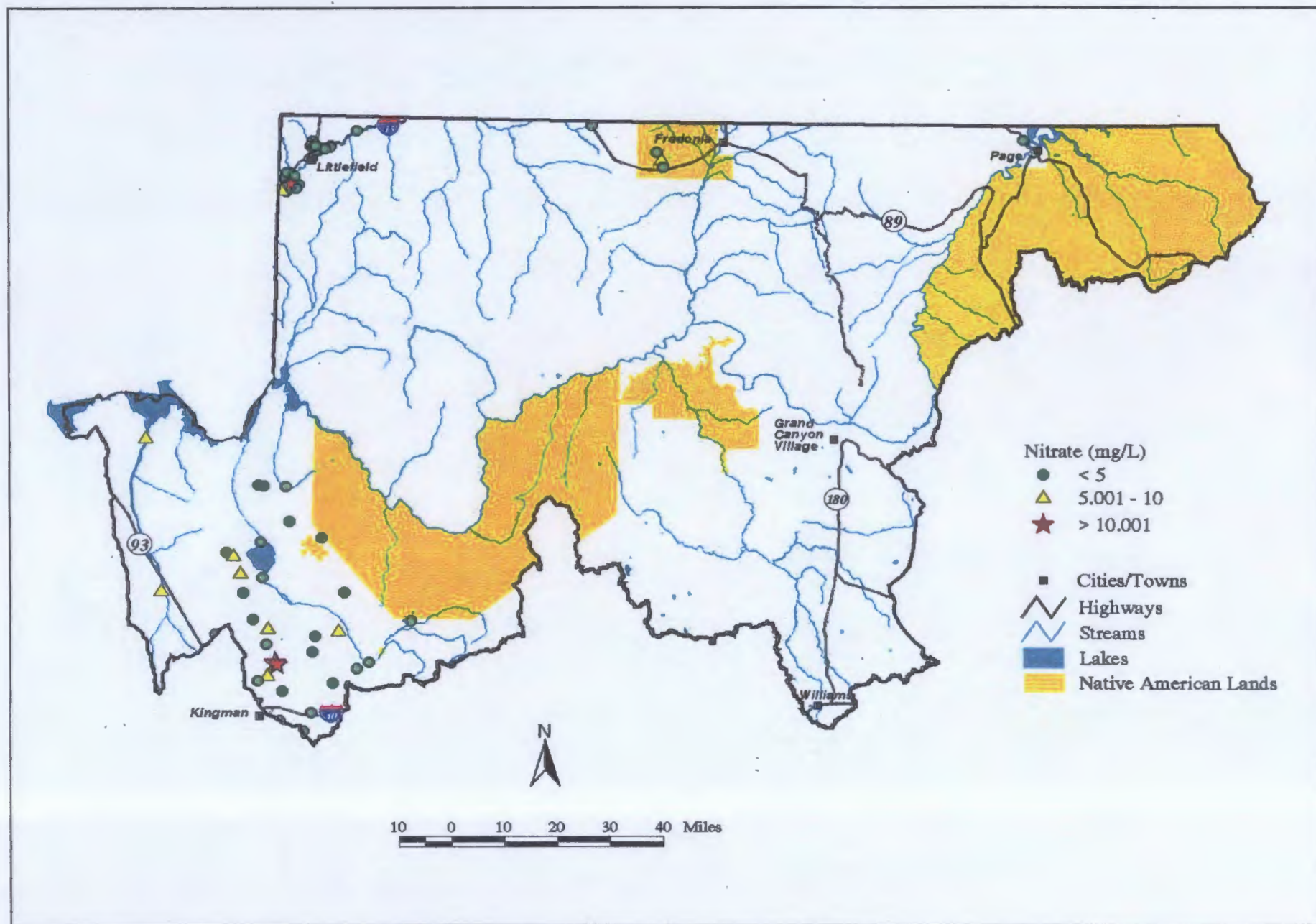


Figure 14. Classification of Ground Water Quality by Nitrate Concentration in the Colorado-Grand Canyon Watershed

Watershed Studies and Alternative Solutions in the Colorado-Grand Canyon Watershed

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Colorado-Grand Canyon Watershed. Watershed partnerships active in this watershed are also cited.

Surface Water Studies and Mitigation Projects

Total Maximum Daily Load Studies – The following TMDL analyses have been completed or are ongoing in this watershed. Further information about the status of these investigations can be obtained by contacting the TMDL Program manager at (602) 771-4468 or at ADEQ's web site:

<http://www.adeq.state.az.us/envirom/water/assess/tmdl.html>

<http://www.adeq.state.az.us/envirom/waters/assess>.

- ▶ **Paria River TMDL** – In 1998, the Paria River was identified as impaired due to turbidity and beryllium, and subsequently included on the 303(d) List of impaired waters. The segment of concern is a 29 mile stretch from the Utah border to the Colorado River at Lee's Ferry. In October 1998, ADEQ developed a cooperative water quality monitoring effort with the Bureau of Land Management, and Northern Arizona University.

Eighty-five percent of the verification samples exceeded the applicable turbidity standard; however, this turbidity is due to a naturally high sediment load generated by the sandstone geology. Further, management practices are in place to minimize potential sources of sediment within the canyon.

The verification monitoring indicated no exceedances for beryllium. Based on this study, ADEQ is proposing to delist turbidity and beryllium. This would remove the Paria River from the 303(d) List of impaired waters.

Water Quality Improvement Grant Projects – ADEQ has awarded the following Water Quality Improvement (319h) Grants for projects in this watershed:

- ▶ **The Greater Kingman Wildcat Dump Cleanup Project** – This project is attempting to reduce wildcat dumping through education and outreach, and to cleanup eighteen wildcat dump sites in the Kingman area because of ground water contamination concerns.

This project was initiated on August 1, 2000, and has conducted workshops, created educational materials, solicited community participation, identified dump sites, and initiated the cleanup. An educational video and brochures have been developed. Brochures are distributed after the video presentations and target the hazards of illegal dumpings.

For more information regarding this project contact: Elno Roundy, Chairman, Northwest Arizona Watershed Council, P.O. Box 3222, Kingman, Arizona 86434.

- ▶ **Abatement of Non-point Source Pollution at Spencer Beach on the Hualapai Reservation** – Spencer Beach is located on the south side of the Colorado River at river mile 246, at the confluence of Spencer Creek with the Colorado River. It is a popular beach used for camping and picnicking by Colorado River rafters and power boaters from Lake Meade. However, this area lacked adequate sanitary human-waste facilities and trash facilities, which raised concerns that the beach and adjacent river water may become contaminated by fecal coliform and polluted with trash.

The project provided a new a composting restroom at the beach in 2000. The existing human waste buried in the beach sand was collected and removed during February 1999. The facility restroom was completed on April 29, 2000. Currently the restroom is reportedly receiving considerable use and the beach appears to remaining free from noticeable trash. The Hualapai tribe is conducting bacterial monitoring at the beach to determine the effectiveness of these measures.

For more information regarding this project contact: Dr. Kerry Christiansen, Senior Scientist, Hualapai Department of Natural Resources, P.O. Box 300, Peach Springs, AZ 86434

► Milkweed Springs Sediment Control and Riparian Enhancement Project

–Milkweed Springs is located along the headwaters of Spencer Creek (which discharges to the Colorado River), on the Hualapai Indian Reservation in northwestern Arizona. In this project structural sediment control measures were installed to minimize sediment due to discharges in the watershed and unpaved roads upstream of Milkweed Springs.

Check dams and filter dams were constructed in critical areas between a constructed gravel road and the riparian area associated with Milkweed Springs and Spencer Creek. During construction, prior to completion of all of the structures, flash flooding knocked out the temporary structures (which were designed to fail in very high flows) and washed away a front end loader belonging to the tribe. The project was finished and the washed out structures rebuilt in 2000. The structures are in place and functioning except for one temporary structure which had partial failure. Areas denuded during road construction were also restored by mulching and reseeding to reduce sediment discharge.

Implementation effectiveness has been measured quarterly through:

- Photo points to document visual changes,
- Flow rate and basic water quality measurements,
- Measurement of sediment trapped behind rock check dams.

More check and filter dams may be needed in the upper watershed, along with improvements in grazing management, to control sedimentation. This project was scheduled for completion in 2001. For more information regarding this project contact: Don Bay, Contracting Officer, Hualapai Department of Natural Resources, P.O. Box 300, Peach Springs, Arizona 86001

• Elimination or Reduction of Impairment to Red Springs, Moss Springs, and the Colorado River in Mohawk Canyon – The Hualapai Indian Reservation was awarded a grant to improve and maintain surface water quality impaired by elevated fecal coliform and sediment levels in the Mohawk Canyon drainage area through the removal of feral horses.

The canyon covers 620 square miles in northwestern Arizona.

Fifty-two feral horses have been removed from Mohawk Canyon by helicopter net-gun capture and two fences have been added to keep horses from reentering the canyon; however, some wild horses remain in the canyon. These horses could have been missed during the roundup or gained reentry into the Canyon because the new fence at upper end of Mohawk Canyon was reportedly washed out. The Hualapai tribe intends to rebuild the damaged fence (at their expense).

Project administrators expect nearly 100% reduction of pollutants following the completion of this project. The Hualapai tribe is to measure the effectiveness of the project through photo-point documentation and water quality sampling to compare conditions before and after this animal removal project.

The completion of this project was scheduled for 2001. For more information regarding this project contact: Don Bay, Contracting Officer, Hualapai Department of Natural Resources, P.O. Box 300, Peach Springs, Arizona 86001.

Water Protection Fund Projects – Arizona Department of Water Resources provided Water Protection funds for the following projects.

- Protection of Spring and Seep Resources of the South Rim, Grand Canyon National Park by Measuring Water Quality, Flow, and Associated Biota – The Grand Canyon National Park received funds to make a hydrologic and biologic assessment (water quality, spring flora, and associated invertebrate fauna inventory) of twelve seeps and springs on the south rim of the Grand Canyon National Park. This assessment and a public outreach effort will be used to develop management objectives and strategies.
- Glen and Grand Canyon Riparian Restoration Project – The Grand Canyon Wildlands Council received a grant to:
 - Restore 10 acres of native cottonwood-willow habitat along the Colorado River at Lee's Ferry and
 - Eradicate tamarisk from 63 tributaries in the Grand Canyon.

Colorado River Basin Salinity Control Program – See earlier discussion of research in the opening section of Volume II.

Human Waste Monitoring of Lake Powell – Glen Canyon National Recreation Area has historically had a problem with fecal material being deposited on and buried in the sandy beaches of Lake Powell. Not only is waste on the beaches unsightly, fecal material may contain pathogens. Because of these concerns Glen Canyon National Recreation Area enacted a rule that requires campers within 1/4 mile of Lake Powell to have and use a device for containing solid human waste unless toilets are available on the beach.

In 1999, six sites were selected to monitor for human waste and determine the effectiveness of the rule (Munill, et al, 2001). Human wastes were counted and cleaned from sites at Romana Cove, Crosby Canyon, Hansen Creek, Moqui Canyon and Warm Creek Beach in Utah. After two years, more waste was being collected than in prior seasons. This may be due to the crew being more adept at locating the wastes.

Selenium Budgets for Lake Powell and the Upper Colorado River Basin – Selenium is a constituent of concern in water in the Colorado River Basin. Since the discovery in 1983 of wildlife deaths and deformities caused by selenium in irrigation drain water in Kesterson National Wildlife Refuge in California, the Department of Interior has investigated the quality of irrigation drain water from 26 projects in western United States. This research has identified the following conditions that individually or in combination may influence concentrations of selenium in irrigation drain water:

- A geologic source of selenium;
- Low rainfall and high evaporation; and
- Topographically closed areas (e.g., impoundments, backwaters).

The purpose of this study (Engberg, 1999) was to determine selenium sources above Lake Powell and selenium mobilization processes in effect.

Based on data collected by the Bureau of Reclamation between 1985-1994, 83% of the selenium entering Lake Powell is accounted for at the output site (flows through the lake). The rest may be incorporated by the lake sediment or used by the biota. Of the selenium that reaches Lake Powell, the Gunnison River Basin produces an estimated 31% and the Grand Valley in Colorado produces an estimated 30%. Irrigation related activities are thought to be responsible for mobilizing 71% of the selenium that reaches Lake Powell.

Selenium concentrations in water at Imperial Dam of the Colorado River upstream of the Mexico international border are similar to those at the output site of Lake Powell. Therefore, most selenium observed in downstream areas of the Colorado River probably are probably derived from the Colorado River watershed above Lake Powell.

Bacterial Monitoring of Lake Mead – The National Park Service collects water quality samples from four coves on Lake Mead in Nevada that get high recreational uses (Boxcar Cove, Sandy Cove, James Bay, and Middle Point). In addition, a sample is collected from Teakettle Cove, a low use cove in Nevada. Samples are analyzed for fecal coliform and *Enterococcus*.

Limnological Investigations of Lake Mead – The US Bureau of Reclamation has been conducting limnological investigations at the Boulder Basin of Lake Mead from 1990 - 1998. The purpose of these investigations were to:

- Collect water quality data that might indicate impacts of the wastewater and other drainage flowing to the Las Vegas Bay from Las Vegas Wash in Nevada;
- Characterize limnological conditions that might affect the quality of water as a public drinking water source;
- Develop new technologies for assessing limnological features of a reservoir relating to water quality; and
- Improve the general understanding of Lake Mead's ecology and its relationship to Colorado River systems (as the Colorado River flows through this large reservoir).

The report concluded that there are summertime oxygen sags due to decomposition of organic material, when *Chlorophyll a* and algae are at peak levels. Storm water runoff negatively impacts Boulder Basin as all parameters evaluated were elevated. No standards were exceeded.

Las Vegas Wash - Lake Mead Water Quality Standards Study – The Nevada Division of Environmental Protection completed a water quality standards study for Las Vegas Wash and Lake Mead in 1998. The study proposed to establish control points along Las Vegas Wash and in Las Vegas Bay in Lake Mead. It also proposed to add aquatic life standards (excluding fish) to the wash and eventually protect Las Vegas Bay for fishing and swimming. Some of the proposed changes included:

- Change pH from 7.0 - 9.0 to 6.5 - 9.0 Standard Units;
- Replace Total Filterable Residue with Total Dissolved Solids;
- Decrease the nitrate standard from 10 mg/L to 5 mg/L;
- Add *Escherichia coli* standards of: 235/100 ml (single sample maximum) and 126/100 ml (30-day geometric mean).

Ground Water Studies and Mitigation Projects

Virgin River Basin Study— The Virgin River Groundwater Basin, located in the northwestern corner of Arizona, encompasses more than 430 square miles. ADEQ conducted a regional study of the this basin in 1997. The Virgin River is a free-flowing major tributary of the Colorado River from its headwaters in Utah to Lake Mead in Nevada. It is characterized by high turbidity and salinity. The Virgin River's largest tributary in Arizona is Beaver Dam Wash, which is perennial for approximately one mile above its juncture with the Virgin. Ground water is the primary source for municipal, domestic, and livestock uses; however surface water is also used for irrigation. Four aquifers were examined in this study. Each aquifer sampled has a unique ground water composition which appears to be related to hydrological and geologic conditions within the basin.

- **Beaver Dam Wash Aquifer** – This aquifer consists of unconsolidated silt, sand, and gravel deposited between steep terraces created by the incision of Beaver Dam Wash. The relatively low parameter concentrations characteristic of the Beaver Dam Wash Aquifer are likely related to the high quality surface water in Beaver Dam Wash.
- **Littlefield Aquifer** – This aquifer is located below the town of Littlefield, and is comprised of alluvial-fan deposits that rest on a limestone formation. This horizontal limestone unit is overlain by alluvial fan deposits and is the likely cause of this saline and very hard ground water.
- **Virgin River Alluvial Aquifer** -- This aquifer consists of the flood plain and terrace alluvium southwest of Littlefield, along the Virgin River. The relatively high parameter concentrations characteristic of the Virgin River Alluvium Aquifer are likely influenced by the saline surface flow of the Virgin River. Factors influencing the Virgin River salinity include an initial high salt concentration, saline spring discharges near the community of Littlefield, and irrigation return flows.
- **Virgin River Basin Aquifer** – This aquifer is composed of the alluvial fan deposits of the Virgin Mountains south of the Virgin River. It

exhibits a mixed chemistry. In contrast to other aquifers, the relatively low parameter concentrations characteristic of the Virgin River Basin Aquifer are likely the result of high quality, recharge from the Virgin Mountains.

Interpretation of these results suggest that ground water in the Virgin River Groundwater Basin supports drinking water uses as only one well exceeded an state aquifer water quality standard. However residents (particularly those utilizing the Littlefield Aquifer or the Virgin River Alluvial Aquifer) may prefer to install water treatment units for domestic use or to obtain domestic water from alternative sources for aesthetic reasons as 25 of the 38 wells sampled (66%) exceeded aesthetic-based criteria. Nitrate, with a few exceptions, was found at levels indicating minimal impact from human activities. These findings suggest that for domestic or municipal use, relatively shallow wells should be used in the Beaver Dam area while deeper wells should be used near the Virgin River.

Ground water Reconnaissance Survey in Mohave County: The watersheds (Sacramento Valley, Big Sandy Valley, Detrital Valley and Hualapai Valley) are all to the south of the Colorado River.

The University of Arizona has been commissioned by the Northwest Arizona Watershed Council (under the Arizona Rural Watershed Initiative) to catalogue the water resources of Mohave County in the Sacramento Valley, Hualapai Valley, Big Sandy Valley, and Detrital ground water basins. This research has two key components:

- To collect all relevant hydrologic data and information into one single source that can then be used by anyone doing any research or contractual work in the region in the future. This includes but is not limited to; Previous estimates of aquifer size, all publicly available studies, Depth to water, drawdown, rainfall measurements, recharge estimates and soil maps.
- To provide a preliminary hydrologic assessment based on the information obtained. This includes an assessment of earlier work to compare and attempt to explain why different aquifer parameters were used by different studies to come up with different figures.

Although this project is Phase I of a multi-phase project, it is anticipated that the result of this study will minimize data collection for others working in Mohave County (e.g., universities, government agencies, or private companies).

For more information contact: Gavin Fielding, Researcher, School of Renewable Natural Resources, 325 Biosciences East, University of Arizona, Tucson, AZ 85721 (gavinfielding@lycos.com) or (520) 621-5211 (for messages only). Fax: (520) 621-8801

Watershed Partnerships

Northwest Arizona Watershed Advisory Council – This council has been supported by the US Bureau of Land Management, and has identified the following key issues: wildcat dumping, ground water protection, and enforcement of existing environmental laws and regulations. This council has been responsible for the cleanup of two wildcat dump sites and is in the process of cleaning up two more sites. For information about group meetings, contact Elno Roundy (cleo@ctax.com).

Lake Mead Water Quality Forum – The Nevada Division of Environmental Protection established this public forum for discussion of water quality related issues pertaining to Las Vegas Wash (Nevada) and Lake Mead. The Forum identified the critical water quality issues facing Lake Mead. In priority order, the issues are:

- Identification of contaminant sources;
- Define the plume;
- Establish Forum water quality goals;
- Determine whether recreation involving water contact is safe in Las Vegas Bay near the inlet of the wash;
- Determine whether fish consumption advisories need to be issued;
- Sediment loading to Las Vegas and its bay;
- Further characterization of wastewater flows and posting of advisories;
- Identification of contaminants which are responsible for endocrine disruption observed in carp.

The Forum supported the National Park Service in posting signs advising that swimming was not recommended in Las Vegas Wash (Nevada).

The Forum has established a centralized database of water chemistry data, assisted in the collection and analysis of sport fish, and acted as an educational resource to the public.

Lake Powell Memorandum of Understanding Group and its Technical Advisory Committee – In 1998, a Memorandum of Understanding among the National Park Service, the US Geological Survey, the US Bureau of Reclamation, the US Fish and Wildlife Service, the US Environmental Protection Agency, Utah Division of Water Quality, Utah Division of Wildlife Resources, Arizona Game and Fish Department and Arizona Department of Environmental Quality was established to provide a mechanism for coordinating programs and initiatives that relate to the protection and understanding of Lake Powell.

For information concerning meetings of the Technical Advisory Committee, contact Mark Anderson at mark_anderson@nps.gov or (928) 608-6377.

Colorado-Lower Gila Watershed



COLORADO-GRAND CANYON WATERSHED CHARACTERISTICS

SIZE	16,437 square miles (14% of the State's land area).					
POPULATION BASE	Approximately 67,500 people live in this watershed (estimated from the 2000 census). This is about 1.5% of the state's population.					
LAND OWNERSHIP (Figure 9)	Bureau of Land Management	32%	Tribal land	22%	National Parks and Monuments	15%
	Private land	13%	U.S. Forest Service	10%	State Land Dept.	8%
LAND USES AND PERMITS (Figure 10)	Most of this watershed is sparsely populated. The largest communities are Kingman and Williams. Land use is primarily a mixture of open grazing, recreation, and silviculture, with scattered mineral districts. This watershed contains the Grand Canyon National Monument, Kaibab National Forest, and Lake Mead and Glen Canyon national recreational areas which all have restricted land uses to protect natural resources. These federal lands also draw a large number of tourists and recreationists.					
HYDROLOGY AND GEOLOGY	<p>This watershed is defined by the Colorado River drainage area within Arizona from Lake Powell to Hoover Dam at Lake Mead, excluding the Little Colorado River drainage through the Grand Canyon National Monument. The Colorado River and many of its tributaries (near their confluence with the Colorado River) are perennial; however, most of the streams in the watershed are ephemeral or intermittent (Brown et al. 1978). The flow in the Colorado River at Lee's Ferry has an average discharge of 17,850 cfs, with a maximum discharge of 97,300 cfs (in 1983). Prior to completion of Glen Canyon Dam in 1963 the maximum flow was about 300,000 cfs (since 1868) (USGS 1996).</p> <p>Several ground water basins are included in this watershed, including: the Coconino Plateau, Detrital Valley, Grand Wash, Hualapai Valley, Kanab Plateau, Meadview, Paria, Peach Springs, Shivwits Plateau, and Virgin River basins, along with minor portions of Big Sandy, Lake Mohave, and the Little Colorado River basins Verde Watershed. The area contains incised canyons formed by erosion of sedimentary formations, volcanically formed mountains, and high plateaus, valleys, and mountain canyons. Aquifers with low water-yields are contained in fractured limestones, sandstones, shales, and igneous rocks. High water-yield aquifers are typically found in alluvium and basin fill deposits in valleys and along rivers. (ADWR 1994)</p> <p>Elevations range from 1,000 feet above sea level along the Colorado River to 12,600 feet at the San Francisco Peaks. Most of the watershed is included in the Plateau Uplands Province (upper elevations), with a portion of the Basin and Range Province (lower elevations)</p>					
UNIQUE WATERS	None					
ECOREGIONS	Primarily the Arizona-New Mexico Plateau, with Arizona-New Mexico Mountains on the eastern edge and Southern Basin and Range on the western edge .					
OTHER STATES, NATIONS, TRIBES	This watershed receives drainage from Utah, Colorado, Wyoming, and New Mexico to the north and Nevada to the west. It discharges to the Colorado-Lower Gila Watershed to the south. Hualapai, Havasupai, Kaibab-Paiute, and Navajo tribal lands occur within this watershed.					

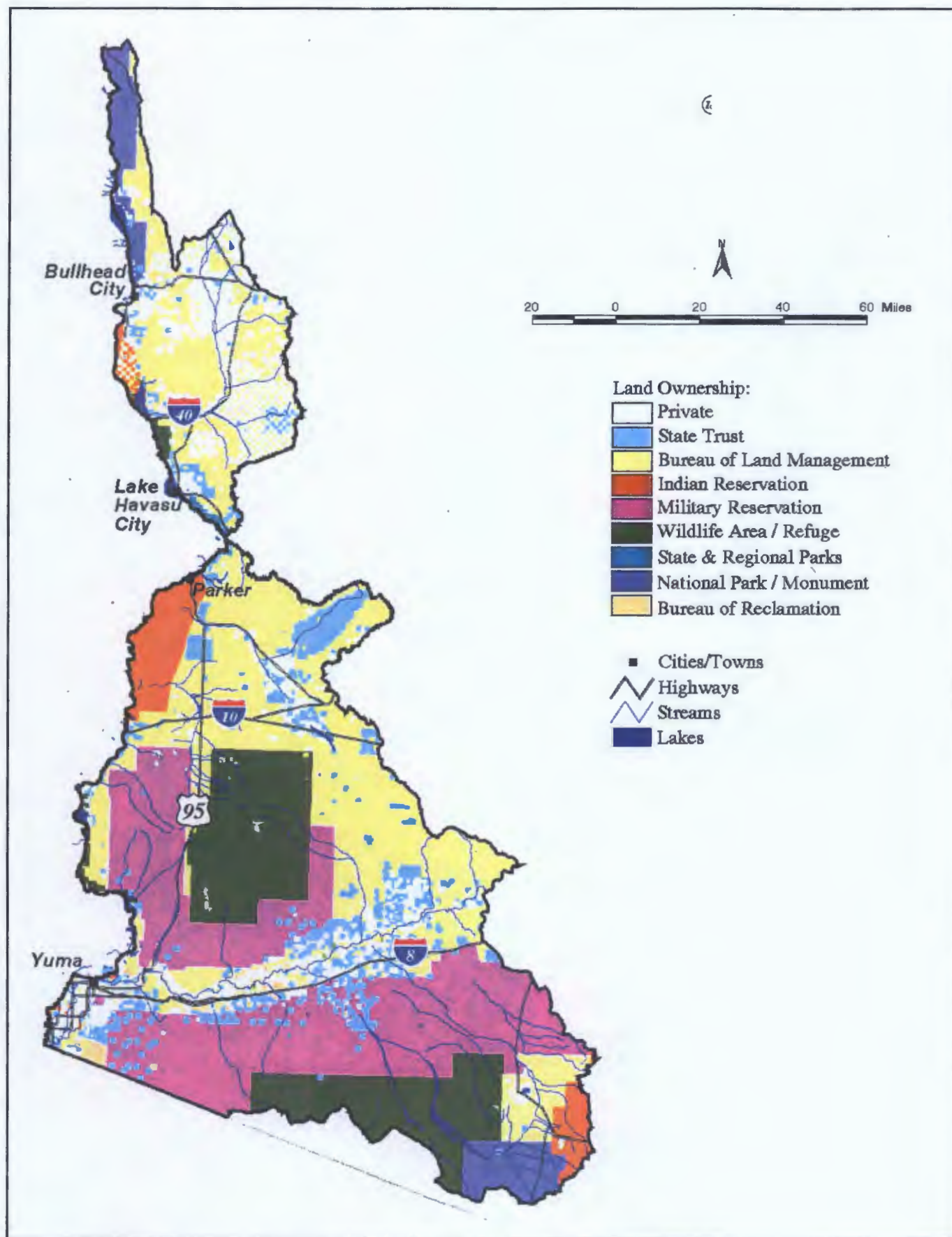


Figure 15. Land Ownership in the Colorado-Lower Gila Watershed

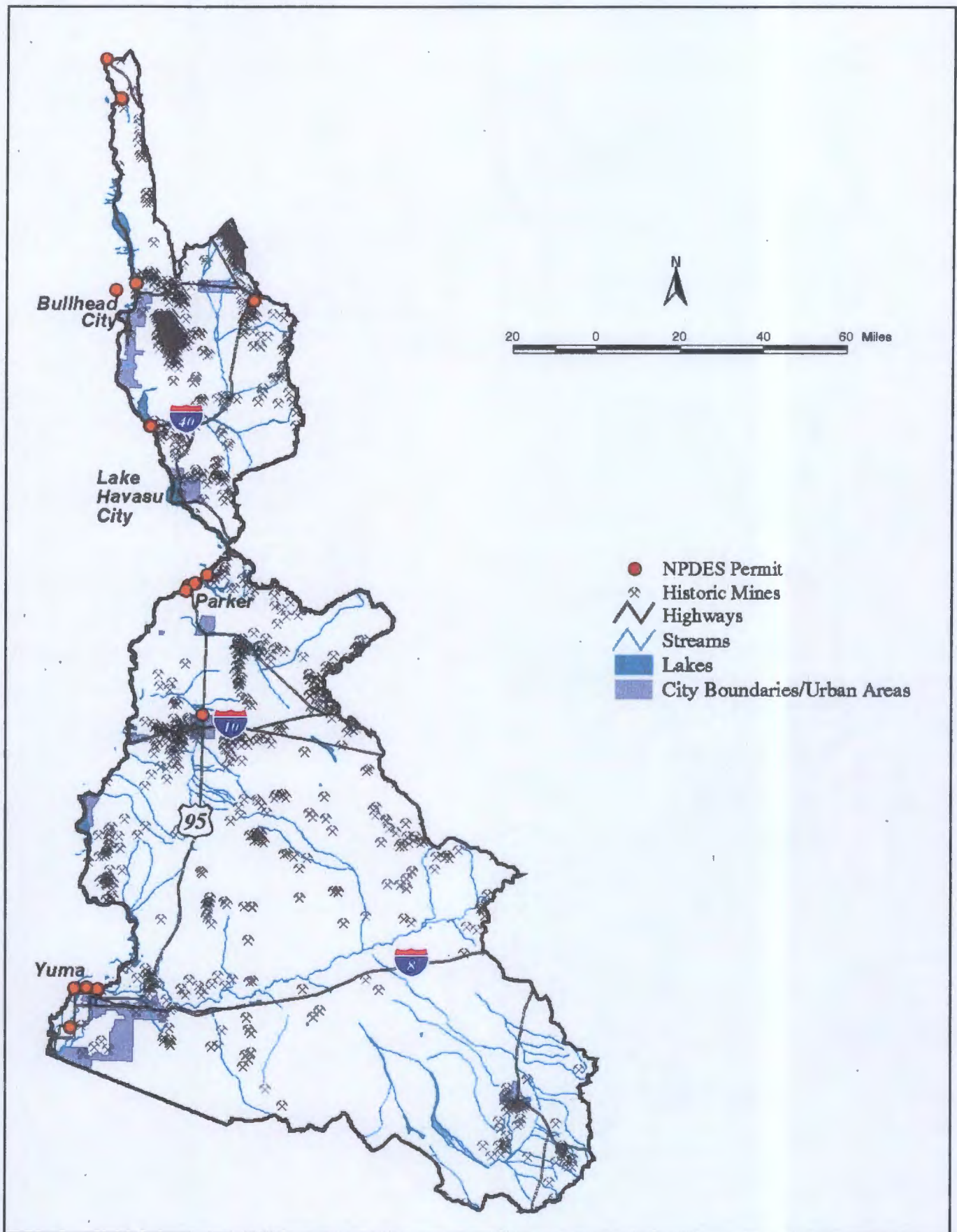


Figure 16. General Land Use and NPDES Permits in the Colorado-Lower Gila Watershed

Colorado-Lower Gila Watershed Assessment Discussion

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 132 stream miles and 29,156 lake acres were assessed. Fewer assessments were completed than previously because of two factors: 1) changes in assessment criteria requiring more data to base an assessment, and 2) a lack of current credible data. This watershed will be a focus for water quality monitoring in 2003.

Water quality assessment information for the Colorado-Lower Gila Watershed is summarized in the following tables and illustrated on **Figure 17**.

Table 9. Assessments in the Colorado-Lower Gila Watershed – 2002

	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	132	5	16,120	1
INCONCLUSIVE	0	0	12,850	1
IMPAIRED	0	0	186	1
NOT ATTAINING	0	0		
TOTAL ASSESSED	132	5	29,156	3

PERENNIAL SURFACE WATERS ASSESSED		STREAMS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	132	5	29,156	3

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial mileage although part of the reach may have ephemeral or intermittent flow.

Inconclusive Assessments – As shown in the following monitoring table, all reaches in this watershed were assessed as “attaining,” however, some of the designated uses were assessed as “inconclusive.” All surface waters with a designated use assessed as “inconclusive” were added to the new Planning List. By the end of the focused watershed monitoring (scheduled in 2003), ADEQ expects to monitor most of these reaches so that all designated uses can be assessed during the following assessment cycle. Other lakes and streams which lack monitoring data will also be monitored depending on resources and priorities.

ADEQ will be coordinating with the USGS and the Bureau of Reclamation, which collect monitoring data on the Colorado River, reservoirs, and back waters, so that future monitoring efforts will better support Arizona’s surface quality water assessments.

Major Stressors – When a surface water is listed as impaired, the pollutants or suspected pollutants causing the impairment are identified. Only one lake is to be listed as impaired in this watershed: Painted Rocks Borrow Pit Lake. This lake is impaired due to low dissolved oxygen and high fecal coliform.

An investigation is needed to determine whether the low dissolved oxygen is due to pollutants or is due to natural drying conditions at the lake. ADEQ has adopted new surface water standards that replace the fecal coliform standard with an *Escherichia coli* standard. These new standards still need to be approved by EPA. If adopted they would bring this lake into compliance with bacterial standards as *Escherichia coli* standards are being met.

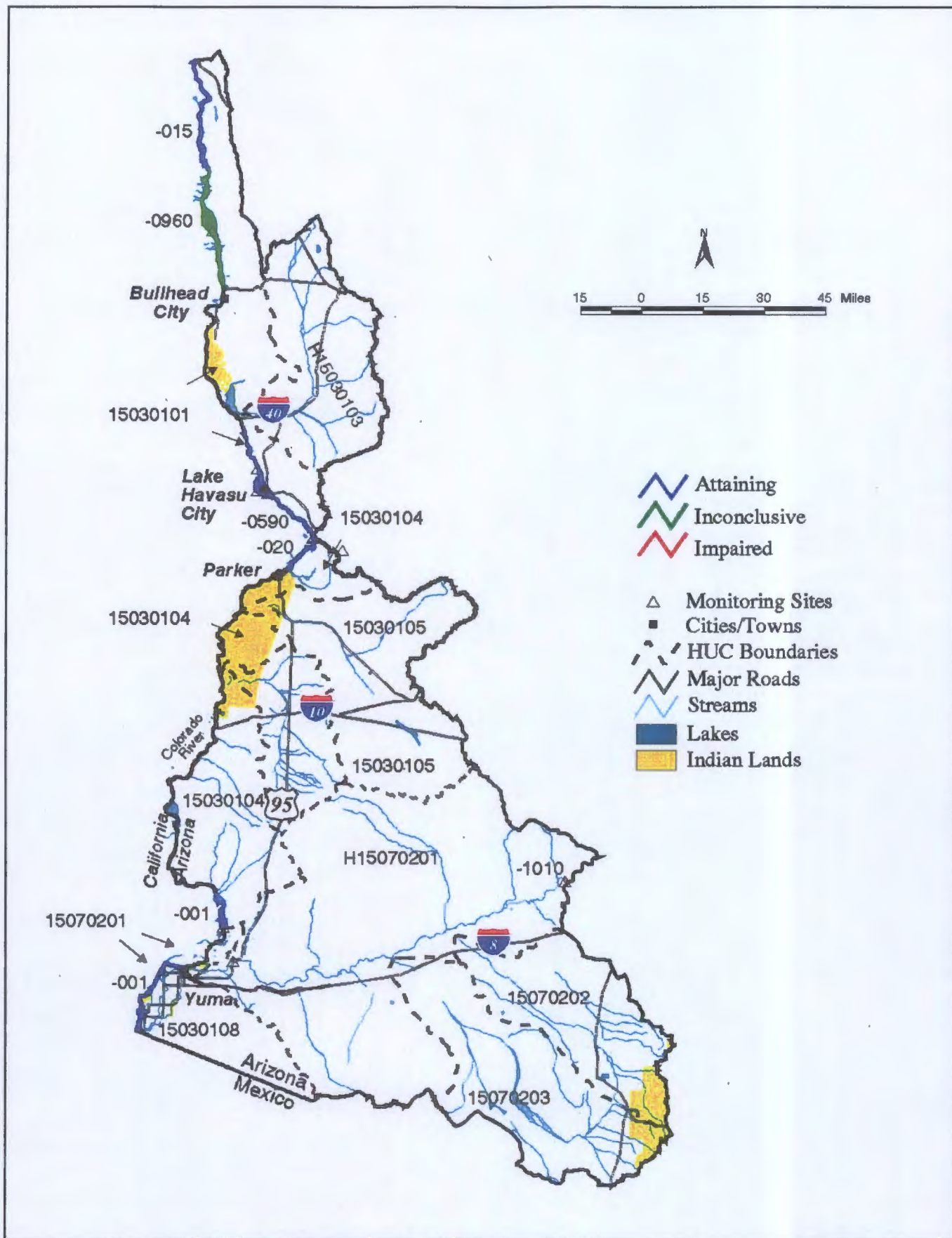


Figure 17. Colorado-Lower Gila Watershed Surface Water Assessments – 2002

TABLE 10. COLORADO - LOWER GILA WATERSHED - 2002 ASSESSMENT - MONITORING DATA

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Colorado River Hoover Dam-Lake Mohave AZ15030101-015 A&Wc, FC, FBC, DWS, Agl, AgL	USGS Station 09421500 At Hoover Dam CMCLR243.26	1996 - 11 suites 1997 - 6 suites 1998 - 6 suites 1999 - 6 suites	Dissolved oxygen mg/L	7.0 90% saturation (A&Wc)	6.1-10.4 56-101% saturation	3 of 29		Naturally occurring low dissolved oxygen caused by water release at dam is from lake bottom. (Not included in the final assessment.) Missing core parameters: total mercury, arsenic, beryllium, barium, fluoride, copper, manganese, and Escherichia coli.
	Reach Summary Row A&Ww Attaining FC Inconclusive FBC Inconclusive DWS Inconclusive Agl Inconclusive AgL Inconclusive	1996-2000 29 sampling events Missing core parameters	OK				Attaining	US Geological Survey collected 29 samples in 1996-1999. Reach assessed as "attaining some uses" and was placed on the Planning List due to missing core parameters.
Colorado River Bill Williams R.-Osborne AZ15030104-020 A&Ww, FC, FBC, DWS, Agl, AgL	USGS Station 09427520 Below Parker Dam CMCLR127.02	1996 - 6 suites 1997 - 6 suites 1998 - 6 suites 1999 - 2 suites, 1 field 2000 - 4 suites	OK					
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining DWS Attaining Agl Attaining AgL Attaining	1996-2000 25 sampling events	OK				Attaining	US Geological Survey monitoring at 1 site for a total of 25 sample events. Reach assessed as "attaining all uses."
Colorado River Indian Wash-Imperial Dam AZ15030104-001 A&Ww, FC, FBC, DWS, Agl, AgL	USGS Station 09429490 Above Imperial Dam CMCLR029.79	1996 - 1 suite 1997 - 6 suites 1998 - 6 suites 1999 - 6 suites 2000 - 3 suites	OK					Missing core parameters: total mercury, arsenic, beryllium, barium, fluoride, copper, manganese, and Escherichia coli.
	Reach Summary Row A&Ww Attaining FC Inconclusive FBC Inconclusive DWS Inconclusive Agl Inconclusive AgL Inconclusive	1996-2000 22 sampling events Missing core parameters	OK				Attaining	US Geological Survey monitoring at 1 site for a total of 22 sample events. Reach assessed as "attaining some uses" and was placed on the Planning List due to missing core parameters.
Colorado River Main Canal-Mexico border AZ15030107-001 A&Ww, FC, FBC, Agl, AgL	USGS Station 09522000 International boundary (Mexico) CMCLR015.85	1996 - 4 suites 1997 - 4 suites 1998 - 6 suites 1999 - 6 suites 2000 - 6 suites	OK					

TABLE 10. COLORADO - LOWER GILA WATERSHED - 2002 ASSESSMENT - MONITORING DATA

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining DWS Attaining Agl Attaining Agl Attaining	1996-2000 26 sampling events	OK				Attaining	US Geological Survey monitoring at 1 site for a total of 26 sample events. Reach assessed as "attaining all uses."
Gila River Coyote-Fortuna AZ15070201-003 A&Ww, FC, FBC, Agl, AgL	ADEQ Fixed Station Network Near Dome, USGS #09520500 LGGLR005.75 100455	1996 - 5 suites 1997 - 3 suites 1998 - 4 suites 1999 - 4 suites 2000 - 4 suites	Boron (total) µg/L	1000 (Agl)	100-1500	4 of 20		
			Dissolved oxygen mg/L	6.0 90% saturation (AW&w)	3.22-11.8 40% - 125%	1 of 18		
			Thallium µg/L	12 (FBC)	2.0 - 20	1 of 19		
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining Agl Attaining Agl Inconclusive	1996-2000 20 sampling events	Boron (total) µg/L	1000 (Agl)	100-1500	4 of 20	Inconclusive	ADEQ collected 20 samples in 1996-2000. Agriculture Reach assessed as "attaining some uses" due to boron exceedances.
			Dissolved oxygen mg/L	6.0 90% saturation (AW&w)	3.22-11.8 40% - 125%	1 of 18	Attaining	
			Thallium µg/L	12 (FBC)	2.0 - 20	1 of 19	Attaining	

LAKES MONITORING DATA								
Lake Havasu AZL15030101-0590 A&Ww, FC, FBC, DWS, Agl, AgL	Mohave County Swimming Area Monitoring CMHAV	2000 - 867 bacteria	OK					
	ADEQ Lakes Program Dam Site, Parker Dam CMHAV-A 100098	1996 - 2 suites 1997 - 2 suites 1998 - 1 suite 2000 - 2 suites	OK					Missing core parameters: bacteria
	ADEQ Lakes Program CMHAV-B 100102	1996 - 2 suites 1997 - 2 suites 1998 - 1 suite 2000 - 2 suites	OK					
	ADEQ Lakes Program CMHAV-C 100099	1996 - 2 suites 1997 - 2 suites 1998 - 1 suite	OK					
	ADEQ Lakes Program Colorado River CMHAV-CRA 100101	1996 - 2 field 1997 - 1 field 1998 - 1 field 2000 - 2 suites	OK					
	ADEQ Lakes Program Crazy Horse Cove CMHAV-CHC 100139	2000 - 1 field, 1 bact	OK					

TABLE 10. COLORADO - LOWER GILA WATERSHED -- 2002 ASSESSMENT -- MONITORING DATA

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Lakes Program CMHAV-E 100100	1996 - 2 suites 1997 - 1 suite, 1 field 1998 - 1 field	OK					Missing core parameters: bacteria
	ADEQ Lakes Program Grass Island CMHAV-GI 100144	2000 - 1 bact	OK					
	ADEQ Lakes Program Hole in Rock CMHAV-HIR 100145	1996 - 2 field 1997 - 2 field 1998 - 1 field	OK					
	ADEQ Lakes Program Off Windsor Beach CMHAV-OFFWB 100155	2000 - 1 field	OK					
	ADEQ Lakes Program Pilot Rock CMHAV-PR 100157	1999 - 2 field 2000 - 1 field	Turbidity NTU	25 (A&Ww)	0.4-77.4	1 event out of 3		(During one sampling event the median turbidity reading was 28.6)
	ADEQ Lakes Program Thompson Bay @ East State Beach Shore CMHAV-ESB 100141	1996 - 2 field 1997 - 2 field 1998 - 1 field 1999 - 1 bact 2000 - 1 field, 1 bact	OK					
	ADEQ Lakes Program Thompson Bay @ East State B. CMHAV-ESBSH 100117	1996 - 2 field 1997 - 2 field	OK					
	ADEQ Lakes Program Thompson Bay @ Golf Course West Shore CMHAV-GCPWS 100143	1996 - 2 field	OK					
	ADEQ Lakes Program Thompson Bay @ Golf Course CMHAV-GCP 100142	1996 - 2 field 1997 - 2 field	OK					
	ADEQ Lakes Program Thompson Bay @ Marina CMHAV-MARA 100167	2000 - 1 suite	OK					
	ADEQ Lakes Program Thompson Bay @ Mid Bay CMHAV-MB 100149	1999 - 1 field 2000 - 2 field	OK					
	ADEQ Lakes Program Thompson Bay @ Mid Channel CMHAV-MC 100150	1999 - 1 bact 2000 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay @ Nautical Bch CMHAV-NB-A 100153	1999 - 1 bact 2000 - 1 field	OK					

TABLE 10. COLORADO - LOWER GILA WATERSHED - 2002 ASSESSMENT - MONITORING DATA

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	ADEQ Lakes Program Thompson Bay @ Nautical Beach (off volleyball courts) CMHAV-NBEAC 100152	1999 - 1 bact	OK					
	ADEQ Lakes Program Thompson Bay @ Rotary Beach CMHAV-ROT1 100121	1996 - 1 field 1999 - 1 bact	OK					
	ADEQ Lakes Program Thompson Bay @ Rotary Beach CMHAV-ROT2 100159	2000 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay @ Rotary Beach CMHAV-ROT3 100122	1996 - 1 field 1999 - 1 bact	OK					
	ADEQ Lakes Program Thompson Bay @ Rotary Beach CMHAV-ROT3 100123	1996 - 1 field 1999 - 1 bact 2000 - 1 bact	OK					
	ADEQ Lakes Program Thompson Bay @ Nautical Cove CMHAV-NAUTC 100151	1996 - 1 field 1997 - 1 field 1999 - 1 bact 2000 - 1 field, 1 bact	OK					
	ADEQ Lakes Program South Channel CMHAV-SC 100164	1999 - 1 bact 2000 - 1 field, 1 bact	OK					
	ADEQ Lakes Program Thompson Bay - West State B. CMHAV-WSB 100166	1996 - 2 field 1997 - 2 field 1999 - 1 bact 2000 - 1 field, 1 bact	OK					
	ADEQ Lakes Program Thompson Bay - West State B. CMHAV-WSBSH 100171	1996 - 2 field 1997 - 2 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-137152 100129	1996 - 2 field 1997 - 2 field 1999 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-137 100125	1996 - 2 field 1997 - 2 field 1999 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-140 100126	1996 - 2 field 1997 - 2 field 1999 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-OW140 100169	1996 - 1 field 1997 - 1 field 1998 - 1 field	OK					

TABLE 10. COLORADO - LOWER GILA WATERSHED -- 2002 ASSESSMENT -- MONITORING DATA

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Lakes Program Thompson Bay CMHAV-142 100127	1996 - 2 field 1997 - 2 field 1999 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-144 100144	1996 - 1 field 2000 - 1 suite	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-147 100174	1997 - 1 field 1998 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-149 100177	1996 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-152 100094	1996 - 2 field 1997 - 2 field 1999 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-152WS 100181	1996 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-149WS 100178	1996 - 1 field	OK					
	ADEQ Lakes Program Thompson Bay CMHAV-OW149 100170	1996 - 1 field 1997 - 2 field 1999 - 1 field	OK					
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining DWS Attaining AgL Attaining	1996-2000 129 Chemistry samples 6 sampling events 867 bacterial samples	Turbidity NTU	25 (A&Ww)	0 -77.4	1 of 112 spatially and temporally independent samples.	Attaining	ADEQ monitoring at 40 sites with a total of 129 samples. Additionally, Mohave County conducted bacteria monitoring at 6 sites with a total of 867 bacterial samples. This lake is assessed as "attaining all uses."
Lake Mohave AZL15030101-0960 A&Wc, FC, FBC, DWS, Agl, AgL	ADEQ Lakes Program CMMOH - A 100030	1996 - 1 suite	OK					Missing core parameters: bacteria
	ADEQ Lakes Program CMMOH - CRMR 100031	1996 - 1 field	OK					
	ADEQ Lakes Program CMMOH - CRRR 100032	1996 - 1 field	OK					
	ADEQ Lakes Program CMMOH - E 100033	1996 - 1 suite	OK					

TABLE 10. COLORADO - LOWER GILA WATERSHED -- 2002 ASSESSMENT -- MONITORING DATA

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	AGFD Routine Monitoring Near El Dorado	1996 - 2 suites	OK					Missing core parameters: turbidity, bacteria, all metals, fluoride, boron, barium,
	AGFD Routine Monitoring Near Monkey Rock	1996 - 2 suites	OK					
	AGFD Routine Monitoring Near Hoover Dam	1996 - 2 suites	OK					
	AGFD Routine Monitoring Near Ringbolt Rapids	1996 - 2 suites	OK					
	Reach Summary Row	1996	OK				Inconclusive	ADEQ monitored 4 sites during 1 sample event and Arizona Game and Fish Dept. monitored 4 sites during 2 sample events. This lake is assessed as "Inconclusive" due to insufficient parametric coverage and was placed on the Planning List.
	A&Ww Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive AgL Inconclusive	9 samples 3 sampling events Missing core parameters						
Painted Rock Borrow Pit Lake AZL15070201-1010 A&Ww, FC, FBC, AgL, AgL	USFWS/COE Routine Monitoring LGPRL	1996 - 6 suites, 2 Sulfide 1997 - 5 suites 1998 - 5 suites, 2 DO 1999 - 8 suites 2000 - 2 field, 1 bact, 2 nutrients	Dissolved oxygen mg/L	6.0 90% saturation (A&Ww)	1.77-19.82	7 of 30		
			Sulfide mg/L	0.1 (A&Ww)	0.0-40	1 of 24		
			Fecal Coliform CFU/100 ml	4000 (A&Ww, FBC, AgL)	10-200,000	5 of 21		
			pH (high) SU	6.5-9.0 (FBC, AgL)	6.99-9.46	1 of 30		
	Reach Summary Row	1996 -2000	Dissolved oxygen mg/L	6.0 90%saturation (A&Ww)	1.77-19.82	7 of 30	Impaired	US Fish and Wildlife Services conducted monitoring at 1 sites with a total of 30 sample events. Lake assessed as "Impaired" due to fecal coliform and low dissolved oxygen. Fish tissue contamination by historically used pesticides has lead to a fish consumption advisory. FC is assessed as Inconclusive.
	A&Ww Impaired FC Inconclusive FBC Attaining AgL Impaired AgL Impaired	sampling events 30	Fecal Coliform CFU/100 ml	4000 (A&Ww, AgL, AgL)	10-200,000	5 of 21	Impaired	
			pH (high) SU	6.5-9.0 (FBC, AgL)	6.99-9.46	1 of 30	Attaining	
			Sulfide mg/L	0.1 (A&Ww)	0.0-40	1 of 24	Attaining	

Information for interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from combining the following: AZ (for streams) or AZL (for lakes) + a US Geological Survey Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses," "Agency," and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year" is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
 - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among the many monitoring entities that provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
 - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
 - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters

- "Standards Exceeded at this Site per Sampling Event."
 - Although many parameters may be analyzed, only those exceeding a standard are shown. Other parameters were collected.
 - "OK" indicates that no standards were exceeded.
 - The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
 - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
 - A mean, geometric mean, or median will be shown along with the range of results if applicable to the standard or assessment criteria.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or "Inconclusive." See assessment criteria in Chapter III of Volume I.

Ground Water Assessments in the Colorado-Lower Gila Watershed

Major Ground Water Stressors – Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 11** and illustrated in **Figure 18, 19, and 20**. As **Table 11** indicates, wells are sampled for different constituents.

Many of the wells monitored (**Figure 18**) were part of two ground water basin studies conducted in this watershed Section. These studies provide a lot of information about water quality in this watershed. See the discussion of these two studies in the Watershed Studies and Alternative Solutions (following the maps).

All of the radiochemical exceedances appear to be related to the Sacramento Ground Water Basin study. Fluoride and nitrate contamination seems to be widespread across the watershed, while metal and volatile organic chemicals contamination is isolated in pockets. It is interesting to note that although significant irrigated crop production has occurred in this watershed, no pesticides exceeded any standards and only six (6) wells among the 120 wells monitored even detected pesticides. Note that wells are not normally sampled for radiochemicals, volatile organic chemicals, or pesticides, except as part of a special study or investigation due to the high costs of running these analyses.

TDS Concentrations – Water quality can be characterized based on concentration of Total Dissolved Solids. High levels of salinity limits the practical uses of ground water in some areas of this watershed as TDS over 500 mg/L has an off-flavor, and TDS over 1000 mg/L will limit its use for some crops. Of the 151 wells monitored for TDS, 85% were over 500 mg/L and 61% were over the 1000 mg/L. As illustrated in **Figure 19**, very high TDS concentrations occur in wells in the Yuma area. (See TDS discussion in the Yuma Groundwater Basin study.)

A flow-weighted average annual salinity surface water standard is established on the Colorado River below Hoover Dam, below Parker Dam, and at Imperial Dam in this watershed. These standards were established by Arizona as part of the federally administered Colorado River Basin Salinity Control Program, and these standards are being met. (More information about the Colorado River Basin Salinity Control Program is provided in the statewide research discussion of this report.)

The elevated levels of TDS do not present a human-health concern for drinking waters. The TDS concentration is only used to generally characterize water quality.

Nitrate Concentrations – Water quality can also be characterized by looking at the concentration of nitrates in ground water. Naturally occurring nitrate concentrations in ground water are generally below 3 mg/L. Concentrations above 5 mg/L indicate potential anthropogenic sources of nitrate. Of the 196 wells monitored for nitrate, 30% exceeded this 5 mg/L concentration. As illustrated in **Figure 20**, these wells are scattered across the watershed. These areas may be related to historic irrigated agriculture or septic systems.

When nitrate concentrations exceed 10 mg/L, Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health, as water with nitrate greater than 10 mg/L may present a health problem for babies and should not be consumed by nursing mothers. **Thirty-five of the 196 wells monitored (18%) exceeded 10 mg/L.** As many of these wells may be irrigation wells (not used for drinking water), nitrates over 10 mg/L may not represent a human-health concern. However, efforts should be made to minimize further contamination of ground water by nitrate.

Table 11. Colorado-Lower Gila Watershed Ground Water Monitoring 1996 - 2000

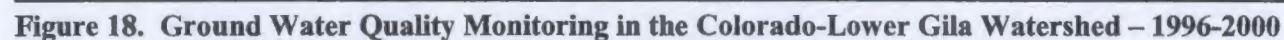
MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	34		8	23%
	Fluoride	43		2	5%
	Metals/Metalloids	43		0	0%
	Nitrate	44		8	19%
	VOCs + SVOCs*	39	2	0	0%
	Pesticides	39	2	0	0%
TARGETED MONITORING WELLS	Radiochemicals	6		4	67%
	Fluoride	142		27	10%
	Metals/metalloids	153		12	8%
	Nitrate	152		27	18%
	VOCs + SVOCs*	81	11	8	10%
	Pesticides	81	4	0	0%

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
151	22	37	80	12

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
196	137	24	35

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.

*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.



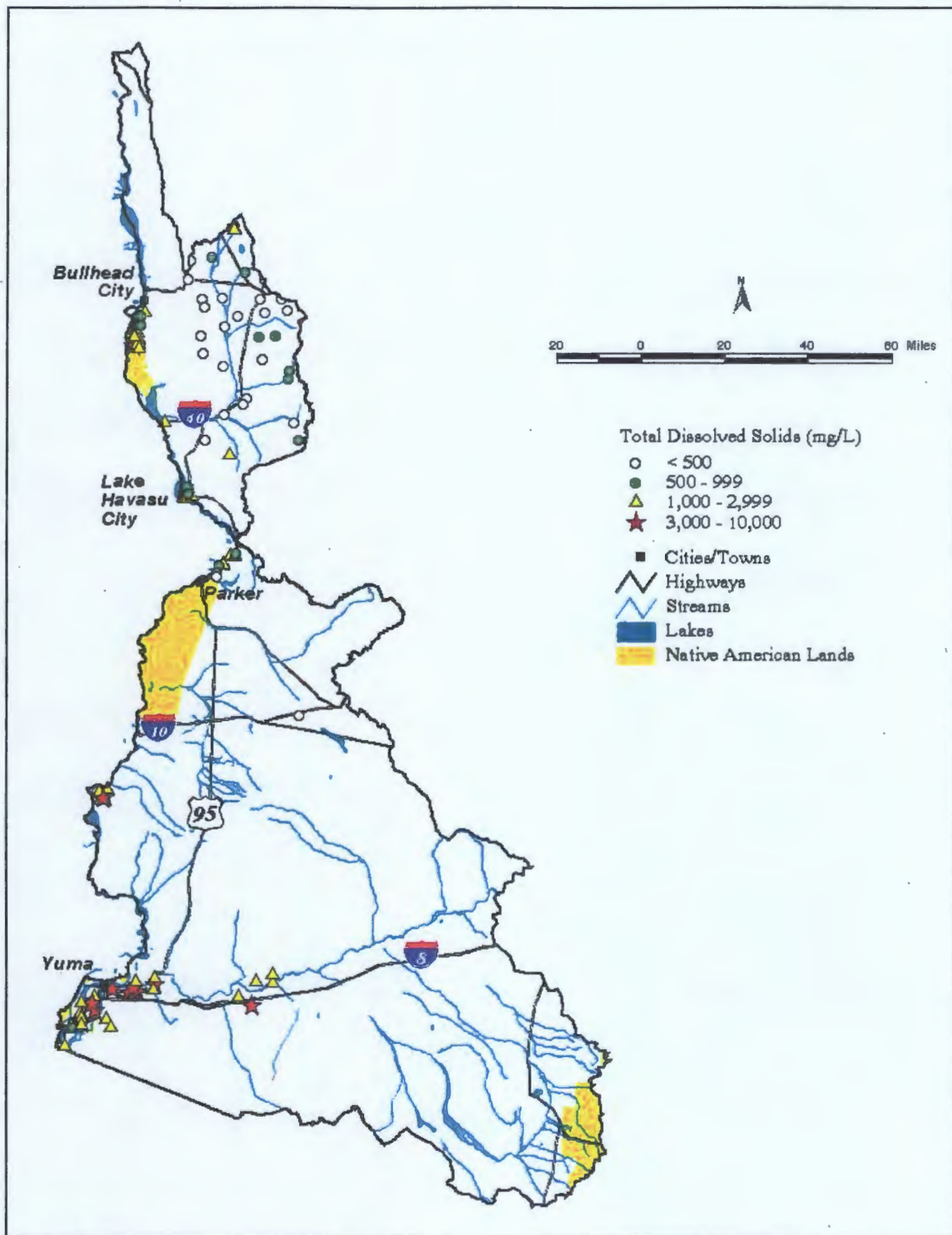


Figure 19. Ground Water Quality by TDS Concentration in the Colorado-Lower Gila Watershed

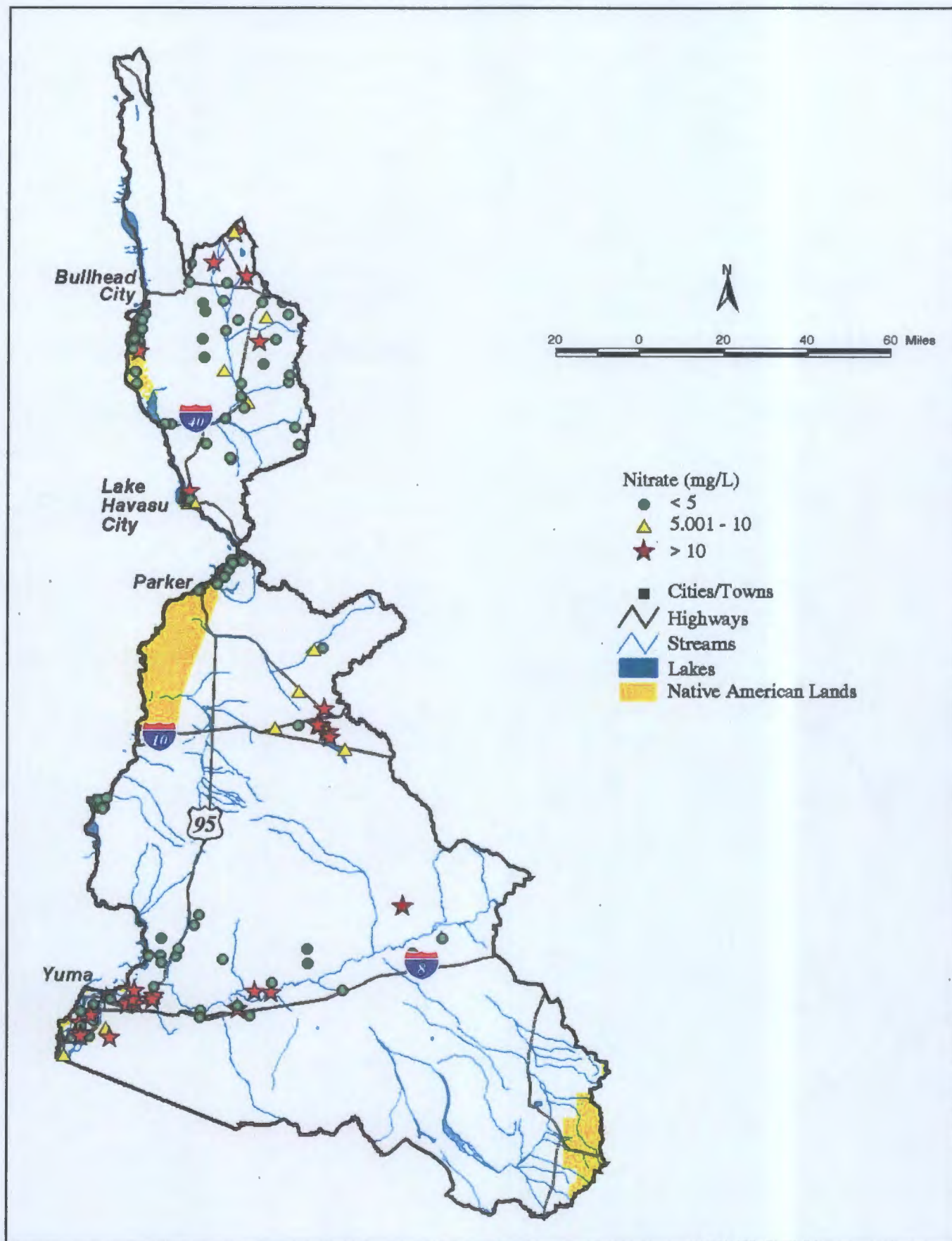


Figure 20. Ground Water Quality by Nitrate Concentration in the Colorado-Lower Gila Watershed

Watershed Studies and Alternative Solutions in the Colorado-Lower Gila Watershed

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Colorado-Lower Gila Watershed. Watershed partnerships active in this watershed are also mentioned.

Surface Water Studies and Mitigation Projects

Yuma East Wetlands Restoration – The Yuma East Wetlands extends along the Colorado River from the Gila confluence to the Ocean-to-Ocean Bridge between the north and south river levees. The restoration area includes 1100 acres of riparian habitat, 148 acres of open water, 98 acres of marshland, and 20 acres of agriculture. The Yuma East Wetlands Restoration Plan (developed by Philips Consulting for the Riverfront Development Office, City of Yuma) aims to restore native riparian, wetland, and aquatic habitats along the lower Colorado River and create an interpretive, cultural center, and nature park for education and low-impact recreation opportunities.

Over the past century, riparian areas surrounding the Yuma East Wetlands have been drastically altered. Fires and human consumption have decimated native stands of cottonwood, willow, and mesquite (honey and screwbean), while the non-native salt cedar populations have overrun the river area. The historic damming and confinement of the river channel have decreased seasonal flooding, ending the natural process of soil desalinization. Where soil salt levels have increased, trees such as the cottonwood and willow, which cannot tolerate high soil salt levels, have been unable to thrive and regenerate. Thus, salt cedar (perfectly suited to high salt levels) thrives in the absence of serious competition from native plant species. Unfortunately, salt cedar, for various reasons, supports less wildlife than native vegetation. Wildlife populations, especially migratory bird populations, have declined with the loss of suitable habitat.

While simple replacement of salt cedar by native vegetation is problematic, the restoration of native vegetation through removal of exotic species on the first (lower) terrace, the use of excavated materials to assure hospitable soil for a second terrace, along with extensive soil sampling at planting sites, should encourage the return of native vegetation and wildlife. In conjunction with these proposed actions, the natural sediment influx and flooding from the Gila River will allow for the continued regeneration of native plants (such as cottonwood

and willow).

Yuma East Wetlands revegetation activities will commence in areas deemed suitable for revegetation. Site selection criteria will be established to select optimum revegetation areas. The goal is to maximize successful establishment of native species, minimize amount of future maintenance required, and design stands to minimize threat from wildfire.

Revegetation activities will be monitored for success, to guide future maintenance activities and optimize future revegetation projects on the lower Colorado River. Monitoring will include bird censuses to establish base line data, protect sensitive species, and monitor success of revegetation efforts.

An interpretive center and nature park is proposed to act as the main staging area for the entire project. This area could accommodate the Yuma East Wetlands offices, a children's center, traditional gardens, ceremonial grounds, a swimming beach and fishing area, picnic areas, shade ramadas, and a trail system that connects the interpretive center with the surrounding historical sites. This area may also serve as an outdoor, cultural and environmental classroom for community schools and organizations. It will be ideal for hosting traditional community gatherings, field trips, special interest groups, summer camps and act as a staging ground for Yuma East Wetland activities.

Other low-impact recreational opportunities in the Yuma East Wetlands will include bird observation platforms with interpretive signs, a canoe trail along the main river channel with primitive day use facilities and wildlife/bird watching trails in the restored areas.

The combination of restoration, education, and intercommunity involvement will add to the success of this important restoration project. The projects goals include the following items:

- Enhance the natural river channel dynamics by manipulating sediment loads, thereby decreasing river maintenance requirements.
- Excavate historic channels to improve water quality and flow in the existing wetlands.
- Stabilize excavated channel material, riverbanks, and sensitive lowland

sites using revegetation methods.

- Improve hydrology and enhance wetlands and backwaters utilizing new and existing water control structures, such as the filtered effluent from the city of Yuma water plant.
- Create and enhance fish and wildlife habitats in the wetlands.
- Establish native fish habitat, isolated from the main river channel.
- Establish an interpretive, cultural center, and nature park for education and low-impact recreation opportunities.
- Improve safety and aesthetic value by cleaning up illegal dumping sites in the project area.
- Reduce the amount of undesirable and illegal human activities by relocating homeless Yuma East Wetland residents in a respectful and helpful manner.
- Involve the Quechan and Yuma communities throughout all aspects of the restoration operations. Respect Quechan Tribal cultural resources and values throughout the planning and restoration process. Provide cultural, educational and economic opportunities for the Yuma and Quechan communities.

In addition to the Quechan Indian Nation, this project involves a number of public and private landowners and stakeholders including, the City of Yuma, the Bureau of Land Management, the Bureau of Reclamation, Arizona State Land Department, United States Fish and Wildlife, Arizona Game and Fish. It is important that the wildlife and natural resources of this area be preserved for present and future generations.

Regrowth of Fecal Coliform in Swim Areas of Lake Havasu, Arizona – In 1994, extremely elevated concentrations of fecal coliform bacteria (greater than 80,000 CFU/100 ml) were detected in several swim areas of Lake Havasu, and another occurrence at lower concentrations the following year. Because these concentrations far exceeded the Arizona surface water quality standard for swimming areas (800 CFU/100 ml at that time), many swim areas were closed in 1994 and 1995, disrupting the economy of the commercial resorts and recreation areas.

ADEQ led extensive investigations into the nature and cause of these high bacteria concentrations (ADEQ, 1997). The investigations focused on the following aspects of the phenomenon:

- Spatial and temporal distribution of bacteria in swimming area waters;

- Chemistry of lake water, ground water, and shoreline sediments;
- Speciation of bacteria within the fecal coliform group and related microbiological investigations of parasites, viruses, and pathogenic organisms;
- Thermal structure and hydraulic characteristics of the lake;
- Water and nutrient materials balance of the municipal wastewater treatment plant located on an island in Havasu Lake and the treatment plants related irrigation and fertilization practices; and
- Regrowth of fecal coliform bacteria in shoreline sediments and water.

This report indicates a link between the discharge of wastewater from the city's onsite wastewater treatment plant, elevated water temperatures, and elevated *Escherichia coli* in swimming areas. The link is not based on the transport of bacteria, but may be due to nutrient enrichment. Long-term recommendations included reducing and eliminating the discharge of effluent on the Island. Short-term recommendations encouraged the dredging, resanding, and rototilling all beaches and coves where fecal coliform exceeded the standards.

Water Quality Improvement Grant Projects – ADEQ has awarded the following Water Quality Improvement (319h) Grants:

- The Greater Kingman Wildcat Dump Cleanup Project – (See discussion in the Colorado-Grand Canyon Watershed.)

Water Protection Fund Projects – The following projects received Water Protection Funds from ADWR.

- Lower Colorado River - Imperial Diversion Restoration – The Bureau of Reclamation is restoring stream flow to small backwater channels and about 50 acres of dried-out wetlands along the lower Colorado River. Areas will be revegetated with native riparian plant species. The grantee hopes to create higher quality riparian and aquatic habitat along this reach of the river.
- Ahakhav Tribal Preserve - Deer Island Revegetation – The Ahakhav Tribal Preserve on the Colorado River Indian Reservation is approximately 1042 acres in size. The construction of dams and channelization of the Colorado River, as well as the introduction of the exotic and invasive salt cedar, has left the Preserve nearly devoid of cottonwoods and willows. Because salt cedar does not provide

adequate cover, food and thermal protection, this habitat type supports a significantly lower diversity of insects, birds and other wildlife. The Colorado River Indian Tribes removed low-quality exotic plants near the Deer Island backwater, and revegetated the site with native plants including cottonwood, willow, mesquite, wolfberry and four-wing saltbush. The project was completed in 2000.

- Watershed Restoration at the Yuma Conservation Gardens – Yuma Conservation Garden received funding to renovate a five acre model watershed that is used as an outdoor classroom at the Yuma Conservation Garden. The Garden is a 28-acre natural area established in the 1950's for education and recreational purposes. The project area was established in 1962, and is used to teach the public about watershed issues in the Yuma area. The project was completed in 2000.

Colorado River Sediment Chemical Analysis – In 1998, the Bureau of Reclamation collected sediment samples of the Colorado River from the Morelos Dam to the confluence with the Gila River. The purposed of the study was to assist in evaluating dredging options, including disposal of dredged materials. Samples were collected every two miles and at three depths: surface, five to ten feet, and 10 to 15 feet.

Results indicated that soils in this segment are typically sands, with low levels of toxic contaminants. For this reason, the US Army Corps of Engineers classifies these soils as "category 1" materials which do not require further sampling and testing under section 404 of the Clean Water Act governing dredge and fill activities.

Colorado River Basin Salinity Control Program – (See previous discussion in Section III of this report.)

US Fish and Wildlife Service Studies – The US Fish and Wildlife Service has conducted several studies to look at contaminants in bottom sediments, fish, and wildlife. The following studies have been recently completed by them or by University of Arizona (UA) students under grants from the USFWS.

- *Dynamics of Selenium in Cibola Lake, Arizona.* This is a UA PhD dissertation completed in 1997 by S.V. Villegas.
- *Selenium and Water Quality in Three Wetland Types along the Lower Colorado River – Imperial National Wildlife Refuge.* This is a UA

masters thesis by F.G. Prieto, written in 1998.

- *Reproductive impacts of elevated selenium levels.* This was completed by K.D. Estrada and O.E. Maughan at the UA in 1999.
- *Environmental contaminants in Fish and Wildlife of Havasu National Wildlife Refuge, Arizona* was published in 1996. This study was designed to assess the level of selenium, organochlorine pesticides (historically applied pesticides), and trace elements in fish and migratory birds of the Colorado River adjacent to and within the Havasu National Wildlife Refuge. The following conclusions were made in this study:
 - ▶ The organochlorine pesticide compounds do not present a threat to fish and wildlife;
 - ▶ Elevated levels of arsenic, cadmium, chromium, copper, lead and selenium may be a concern to fish and wildlife.
 - ▶ Selenium concentrations were elevated in all biota, and research should continue to identify effects of selenium in fish and fish-eating birds, including monitoring reproductive success and teratogenesis (developmental malformations).
- *Field Screening of Water Quality Bottom Sediment, and Biota Associated with Irrigation Drainage in the Yuma Valley, Arizona, 1995* (Tadayon, King, Andrews, and Roberts, 1997). This study was completed in cooperation with the US Geological Survey. Water, bottom sediment, and biota were collected along the lower Colorado River and in agricultural drains at nine sites in the Yuma Valley, Arizona. The study made the following conclusions concerning water quality:
 - ▶ Selenium exceeded chronic Aquatic and Wildlife standards in only 1 sample;
 - ▶ Trace-element concentrations in bottom sediment samples from the study area were within the ranges found in soil of the western United States and do not indicate a significant accumulation.
 - ▶ DDE was detected in all fish and bird samples, and only one sediment sample. Almost half of the fish contained DDE at levels 2.5 times higher than the national mean concentration, and 23% of the fish were 3 times the national mean. Although DDE was elevated in birds, fish, and eggs, concentrations generally were below thresholds associated with chronic poisoning and reproduction problems;
 - ▶ Although 18 metals were detected in aquatic and wildlife, none

occurred at a frequency or at concentrations that would cause concern for fish and wildlife populations, except for selenium in killdeer. Selenium in a killdeer-liver sample was at potentially toxic levels.

- *Contaminants in Potential Prey of the Yuma Clapper Rail: Arizona and California, USA, and Sonora and Baja, Mexico, 1998-1999* was published in 2000. Potential food items for the Yuma clapper rail (a federally listed Endangered species) were collected along portions of the lower Colorado River below the Havasu National Wildlife Refuge. This report made the following conclusions and recommendations:
 - ▶ If selenium concentrations in crayfish (the primary prey species for the Yuma clapper rail) continue to increase two to five-fold (as it did in the past 10 years), the Yuma clapper rail populations, as well as those of other invertebrate and fish eating birds could experience selenium-induced reproductive failure and subsequent population declines. Further water management studies in backwater areas are needed.
 - ▶ Additional prey samples should be collected on a three to five year cycle to monitor trends in selenium bioaccumulation. If adult or nestling Yuma clapper rails are found dead, or unhatched eggs are located, samples should be collected for chemical analysis.
 - ▶ Monitor nests of Yuma clapper rails, or similar species, to determine reproductive success and document any anomalies in the young.
- *Contaminants in Bats Roosting in Abandoned Mines at Imperial National Wildlife Refuge, Arizona, 1998-1999* was published in 2001. This report documents levels and potential effects of trace elements and organochlorine pesticide concentrations in four bat species collected from four abandoned mines on the Imperial National Wildlife Refuge and from three southern Arizona reference sites. Bats now have the highest percentage of endangered and candidate species among all land mammals in the United States. The study made no associations between contaminants in bats and water quality but was concerned with contaminated soils in and near the mines.

Ground Water Studies and Mitigation Projects

The Sacramento Valley Groundwater Basin Study – This ground water basin, located in northwestern Arizona, is an arid region with striking natural

landscapes and a small, but rapidly growing population. Population increases are influenced by proximity to popular tourist destinations such as the Colorado River and Laughlin, Nevada, and by an abundance of relatively inexpensive and undeveloped private land. Ground water is the primary water source for municipal, domestic, industrial, mining, livestock, and irrigation in the basin. Population growth and associated economic development in the Sacramento Valley Groundwater Basin will likely increase demand on ground water and, over time, may influence water quality.

These ground water quality concerns prompted the Arizona Department of Environmental Quality to conduct a regional ground water quality study in 1999 to determine ground water suitability for drinking purposes, appraise current baseline conditions, and examine spatial ground water quality patterns.

Of the 48 sites sampled in this basin, only 54% met health-based aquifer water quality standards, and only 42% met aesthetics-based criteria. Water quality standard exceedances were identified in the following three principal areas:

- Near the town of Chloride, radiochemicals exceedances appear to be related to granite rock that occurs in much of the Hualapai and Cerbat Mountains. Radionuclide levels in ground water may have been exacerbated by the nearby historic and current mining activity. Nitrate exceedances also occur in this area. These exceedances may be related to the high-density of older septic systems used for domestic and commercial wastewater treatment. These systems are often situated in soils that are marginally suitable for septic use.
- In the central and southern Hualapai Mountains, radiochemistry exceedances also occur. In addition, aesthetic-based criteria for TDS, chloride, and sulfate were exceeded in or near the Cerbat and Hualapai Mountains. Previous studies have noted that ground water found in and near mountains is generally more mineralized than ground water in the center of the valley. Different geologic classifications, recharge sources, and precipitation reactions may contribute to this ground water quality pattern.
- Near the town of Topock, fluoride exceeds aquifer water quality standards, and TDS and chloride exceed aesthetic-based criteria. This may be due to dissolution reactions that increase constituent concentrations as ground water migrates down gradient within the basin.

The results of this study can be used in several ways, particularly to assist in the site selection for new wells for public or private drinking water supplies.

The Yuma Groundwater Basin Study - The Yuma Groundwater Basin, located in southwestern Arizona, is an area of startling geographic contrasts. Precipitation in this arid basin averages less than three inches annually, yet because of Colorado River irrigation, it is one of the world's most productive agricultural zones. Similarly, much of this is uninhabited desert, yet the basin has a large and growing population that increases seasonally with the arrival of a large winter visitor population. A variety of water related issues in the basin prompted the ADEQ to conduct a regional ground water quality study of this basin in 1995.

Ground water in the basin is fairly chemically uniform and similar to Colorado River water. This finding supports previous assertions that the ground water consists largely of recharged Colorado River water. Parameter concentration levels, particularly Total Dissolved Solids and major ions, are generally highest in Gila Valley, decline in Yuma Valley, and are lowest in Yuma Mesa.

The source of irrigation water appears to be a major factor in determining ground water quality. Colorado River water, diverted at Laguna Dam, has irrigated land in Yuma Valley and North Gila Valley since 1909. The Imperial Dam, constructed in 1938, largely replaced the functions of Laguna Dam. This dam extended Colorado River water for irrigation to the previously undeveloped Yuma Mesa in the 1940s and to portions of South Gila Valley in 1965, which had been irrigated with ground water since 1910.

Ground water quality often deteriorates in arid irrigated areas due to salt buildup as a result of evapotranspiration. The portion of irrigation water that is actually consumed by plants or lost to evaporation is virtually free of salts. Thus, the vast majority of salts that were in the original irrigation water remain and percolate down eventually to recharge the underlying aquifer. If ground water is pumped for irrigation use on nearby lands and the underlying aquifer receives recharge from the irrigation water applications, this continual recycling of ground water will dramatically increase the salinity of the aquifer over time. This process is exacerbated in areas of shallow ground water where the recycling process occurs quickly, as appears to be happening in South Gila Valley.

In contrast, recharging aquifers with Colorado River water that is lower in salinity (TDS) levels than the ground water would tend to have less of a

cumulative salt load. Water percolating beneath Yuma Mesa moves toward the valleys and is extracted by drainage wells, further minimizing the salt impact there. These processes assist in explaining the high baseline salinity levels found throughout the Yuma Groundwater Basin, the particularly high salinity levels found in the Gila Valley where historically ground water has been used for irrigation, and the salinity differences among sub-areas.

Other factors such as irrigation history, ground water depth and movement, and soil type may also influence the Yuma Mesa's generally lower parameter levels. Irrigation on the mesa is a more recent phenomenon, and ground water depth is much greater. The high irrigation applications necessary to grow crops on the mesa's sandy soils (up to 22 acre-feet per year with citrus) quickly percolate. The resulting recharge and its associated salt load is largely flushed away from the ground water mound that has formed below the mesa toward both valleys. Interpretation of this study's results suggests that regional ground water quality conditions in the Yuma Groundwater Basin generally support drinking water uses, except for nitrate in the eastern South Gila Valley. However, Yuma area residents may prefer to use treated water or other sources for domestic purposes because of high salinity levels. Currently applied pesticides do not appear to be migrating to the ground water, perhaps because of their short half-lives. The banned pesticides, DBCP and EDB, which were detected in the early 1980s, appear to have been transported from the area via rapid ground water movement in the basin.

Cibola Ground Water Quality Study -- In 1997, ADEQ conducted a ground water quality study in Cibola, a small community located in southwestern La Paz County, Arizona. The area has experienced rapid development of winter and summer homes, and La Paz County expressed concerns that the related rapid increase of on-site wastewater disposal systems (septic systems) could pose a threat to ground water quality. La Paz County requested that ADEQ assist in collecting ground water quality data to identify potential sources of ground water contamination and assist in planning for future development.

ADEQ sampled five wells in the study area to evaluate the potential impacts from irrigated agriculture and on-site wastewater disposal systems on shallow ground water in this river aquifer system. Wells were sampled for dissolved metals, major cations and anions, nitrate and ammonia. None of these samples exceeded Arizona's Aquifer Water Quality Standards. However, aesthetic-based secondary drinking water criteria were exceeded in all five ground water samples as follows:

- Three wells exceeded 250 mg/L for chloride,
- Four wells exceeded 0.3 mg/L for iron,
- Five wells exceeded 0.05 mg/L for manganese
- Five wells exceeded 250 mg/L for sulfate, and
- Five wells exceeded 500 mg/L for total dissolved solids (TDS)

These high concentrations of chloride, sodium, sulfate, manganese and total dissolved solids contribute to aesthetically poor ground water quality (based upon taste, odor or color) in the study area. Although ground water in the study area is of poor aesthetic quality, use of ground water for drinking or cooking does not pose any significant health risk to the residents of the study area.

One sample had a nitrate (as nitrogen) level of 3.57 mg/L, well below the standard of 10.0 mg/L. It may indicate an anthropogenic source of nitrate since natural levels of nitrate are typically below 2 mg/L. Additional sampling would be necessary to determine the source of elevated nitrate levels but they can be added to the ground water by septic systems.

The ground water quality data collected will be useful to La Paz County as baseline data with which to measure the impacts of future development in the study area. The study recommended further monitoring to determine the source of elevated nitrate, and look at seasonal changes due to seasonal variations in population densities. The next study should expand the parameters to analyze for bacteria and where pesticides have been applied, sample for pesticides.

Federal and State Superfund Cleanup Sites — Several state and federal Superfund and Department of Defense cleanup sites are located in the this watershed.

- 20th Street & Factor — The 20th Street and Factor Avenue site in Yuma, Arizona was added to the WQARF Registry in 2000 because of ground water contamination by tetrachloroethene (PCE). The remedial investigation was initiated in November 1999 and completed in June 2001. The draft remedial investigation report and land and water use study will be completed by September 2001.
- Yuma Marine Corps Air Station -- The Marine Corps Air Station Yuma occupies approximately 3,000 acres within the city and county of Yuma, Arizona. In February of 1990, this site was designated a National Priority List Superfund site by the Environmental Protection

Agency. The investigation has been concerned with soil and ground water contamination. The contaminants of concern in soil are asbestos in the form of non-friable asbestos containing material and petroleum hydrocarbons from a jet fuel leak. The asbestos containing material is scattered on top of and buried in the surface soil.

In ground water, the contaminants of concern are trichloroethene (TCE), dichloroethene (DCE), tetrachloroethene (PCE) and petroleum hydrocarbons. The main ground water plume is approximately one mile long and 500 feet wide, and has reached the northwestern base boundary. The maximum concentration of total solvents is currently approximately 270 µg/L.

History: The facility originated during World War II as a training base and is currently being used by the Marine Corps for the training of tactical aircrews. Environmental impacts due to soil contamination and subsequent infiltration to ground water may have resulted from activities at several areas of the base. The shop area (for aircraft and vehicle maintenance since the 1940s) has been the site of disposal and spills. Disposal of waste motor oil, cleaning solvents, battery acid, and anti-freeze occurred outside the base hobby shop from 1960 to the early 1980s. Routine maintenance of vehicles resulted in spills at another site. Materials that could not be recycled, such as waste fuel, were burned at three areas. The Radar Hill burn disposal area had the resultant ash pushed to the south and covered with soil. There are other base landfills that were used for waste disposal, as well as for the application of waste for dust control. Lagoons were built on the base for evaporative sewage treatment, but industrial wastewater was not segregated from domestic sewage waste. Some lagoons have contained oils, paints, acids, caustics, detergents, and photographic fixer and developer. Miscellaneous drummed, solid waste materials were removed for disposal in August 1992.

Remediation activities involved the offsite disposal of about 5000 cubic yards of asbestos contaminated soil (OU-2). Remedial action for the contaminated ground water "hot spot" began in July 1999. Soil vapor extraction is the chosen remedy. The remediation pilot study for the leading edge of the ground water contamination is in operation. The remediation consists of two vertical circulation treatment wells.

- Barry M. Goldwater Range – The Barry M. Goldwater Range is a 2.7 million acre military training area in southwestern Arizona. The range has been used continuously from the 1940s to the present for military ground warfare training, aerial target practice and ground strafing. Waste and spent munitions can be found at numerous sites within the boundaries of the range. The range is under the overall management of the United States Air Force, but is divided into two management units for the Air Force and the Marine Corps. One portion (about 30% of the range) is managed by the US Fish and Wildlife Service as the Cabeza Prieta National Wildlife Refuge.

An Installation Restoration Program by Luke Air Force Base in 1992 identified 218 possible areas of concern. Of these sites, 130 required no further action and were closed, leaving 88 areas. Forty-five of the 88 areas are active operations and are managed under state and federal Resource Conservation and Recovery Act regulations. Of the other 43 sites, additional investigations have been completed at 12 sites (two areas at the Gila Bend Auxiliary Air Field and ten sites dispersed at the former Ajo Air Station, Sentinel Navy antenna site, and various locations within the range).

Currently, only the Ajo sites remain unresolved. Although two cleanups were performed by the Air Force at this site, small pockets of chlordane still exist at the site. ADEQ staff met with USF&WS and Luke Air Force Base on February 7, 2001 to discuss the closing out of the Ajo site. An agreement was reached between the parties on closing out the site which required some additional work by the Air Force Base. The Air Force Base is currently awaiting funding to enable them to proceed.

- Yuma Army Proving Grounds – The US Army Yuma Proving Grounds occupies 870,000 acres on the California-Arizona border north of Yuma. Its western edge is adjacent to the Colorado River. Yuma Proving Grounds was first used by the military in 1942 for training desert troops. Since that time, its mission has added testing and evaluation of a variety of military equipment including: boats, vehicles, well drilling equipment, tanks, and munitions.

The U.S. Army has identified 19 sites where soil and ground waters

samples need to be collected and analyzed to determine the nature and extent of risks posed by contaminants. The contaminants of concern include petroleum hydrocarbons, volatile and semi-volatile organic compounds, and metals. The sites were organized into four operable units based on their proximity to the main post and opportunities for rapid cleanup or similarity for cleanup.

For some sites, data are sufficient to indicate that a remedial response is warranted. Studies are already underway at these sites to determine the appropriate response strategy. The Fuel Bladder Test Area was designated for immediate investigation by the base due to the determination that fuel in the amount of approximately 500,000 gallons may have been released at the site between 1965 and 1975. Analyses of ground water samples from monitoring wells installed during ongoing investigation of the site have shown evidence of petroleum and petroleum by-products. The effectiveness of soil vapor extraction technology was studied in 2000. At another site, the Former Waste Disposal Area, a fence to limit access to the site is being considered as an interim remedial action and an institutional control of the site.

Reports for the remedial investigation sampling and analysis plan, for selected sites, as well as the quality assurance project plan for the Yuma Proving Ground site have been reviewed and approved by ADEQ. Initial field sampling, at some sites, has been completed. Monitoring wells are planned for the Fuel Bladder Test Area and the Former Waste Disposal Area.

Ground Water Reconnaissance Survey in Mohave County: The watersheds (Sacramento Valley, Big Sandy Valley, Detrital Valley and Hualapai Valley) are all to the south of the Colorado River – (See discussion in the Colorado Grand Canyon Watershed.)

Watershed Partnerships

Lower Colorado River Citizens Advisory Council – This advisory group primary focus is Lake Havasu pollution, including potential impacts from litter, gasoline and MTBE, septic systems, and ground water protection. The new council is developing a Watershed-based Plan, identifying new partners, and working to obtain a watershed pilot grant.

Little Colorado-San Juan Watershed



LITTLE COLORADO - SAN JUAN WATERSHED CHARACTERISTICS

SIZE	26,794 square miles (24% of the State's land area).					
POPULATION BASE	Approximately 236,500 people live in this watershed (estimated from the 2000 census). This is about 5% of the state's population.					
LAND OWNERSHIP (Figure 21)	Tribal land	58%	Private land	16%	US Forest Service	11%
	State land	8%	Other state and federal land	3.5%	Bureau of Land Management	2%
	National Parks and Monuments	1.5%				
LAND USES AND PERMITS (Figure 22)	<p>Flagstaff is the largest community in this watershed. Land use on the non-tribal lands outside of Flagstaff is primarily open grazing, forestry, recreation, and mining. Major communities, tribal land, historic mining, roads and the location of facilities with NPDES discharge permits are illustrated on Figure 22.</p> <p>Land and resource preservation and conservation also occur in this watershed with four national monuments, two national forests, and four designated wilderness areas.</p>					
HYDROLOGY AND GEOLOGY	<p>This watershed is defined by the Little Colorado River drainage area, from its headwaters to the Colorado River. The flow on the Little Colorado River is interrupted (i.e., stretches of perennial, intermittent, and ephemeral flow) (Brown et al. 1978). Just above Lyman Lake on the Little Colorado River flow varies from no flow to 16,000 cfs (in 1940), with an average annual mean of 23.5 cfs (USGS 1996).</p> <p>Elevations range from 2,700 feet above sea level where the Little Colorado River joins the Colorado River to 12,600 feet at Humphrey's Peak. Horizontally stratified sedimentary rocks have eroded to form canyons and plateaus. The San Francisco Mountains and White Mountains in the Mogollon Rim are igneous rocks deposited on sedimentary formations caused by recent volcanic activity.</p> <p>Ground water basins include: Little Colorado River Basin, with a portion of the Coconino Plateau Basin. The Little Colorado River Basin contains three stratified regional aquifers of poor water quality. The regional aquifers saturate the sedimentary formations of sandstones and limestones separated by shale and siltstone. Local aquifers are an important water source for domestic use and exist in alluvial deposits, sedimentary, and volcanic portions of the Bidahochi Formation, and various sandstones (ADWR 1994).</p> <p>This watershed is contained within the Plateau Highlands Hydrologic Province</p>					
UNIQUE WATERS	Lee Valley Creek, from its headwaters to Lee Valley Reservoir.					
ECOREGIONS	Primarily Arizona-New Mexico Plateau, with western and southern edges in Arizona-New Mexico Mountains, and the northern fringe in Colorado Plateau.					
OTHER STATES, NATIONS, OR TRIBES	<p>This assessment does not reflect water quality on the Navajo, Hopi, and Zuni tribal lands within this watershed (Figure 21).</p> <p>This watershed receives drainage from Utah to the north, New Mexico to the east, and Colorado to the northeast.</p>					

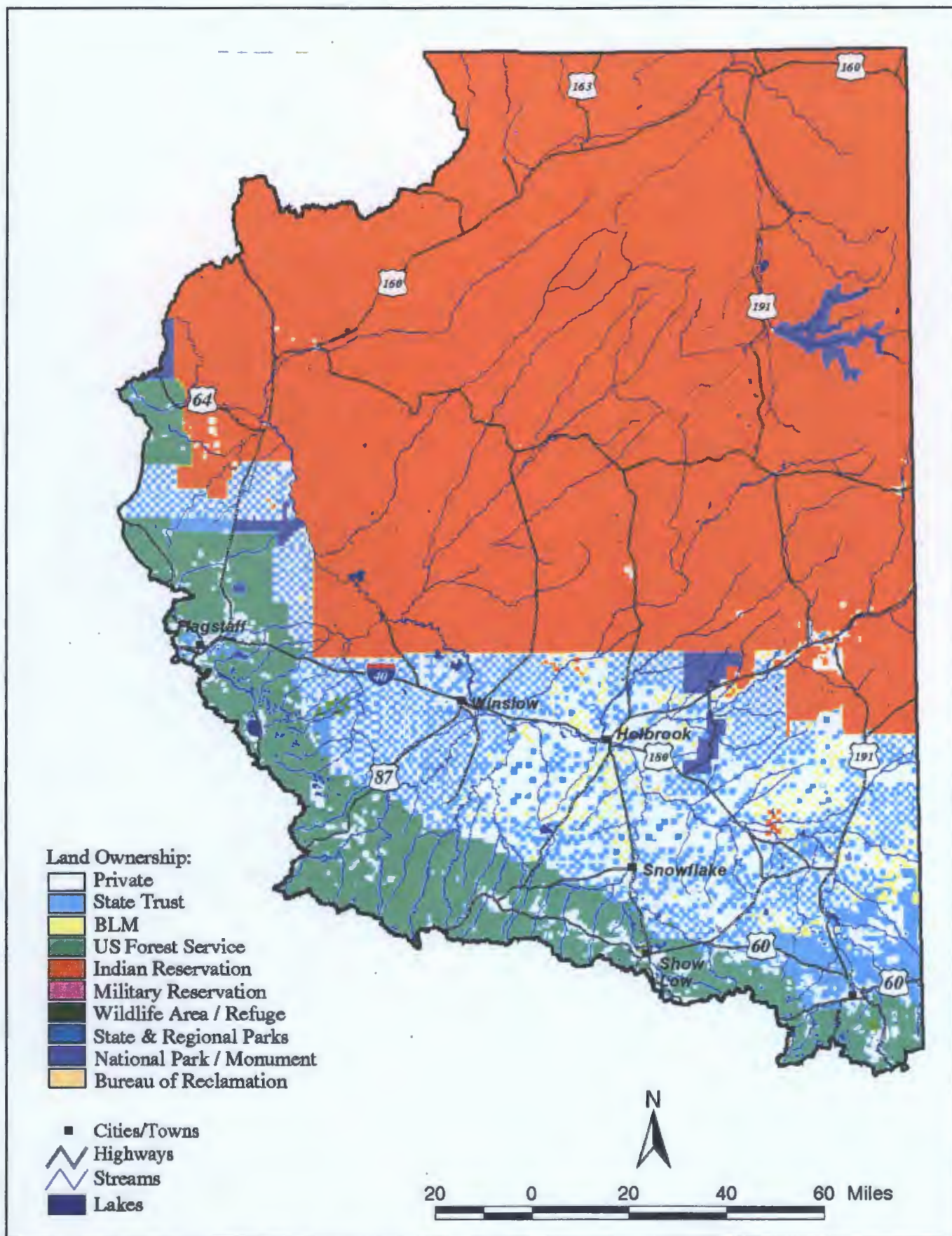


Figure 21. Land Ownership in the Little Colorado-San Juan Watershed

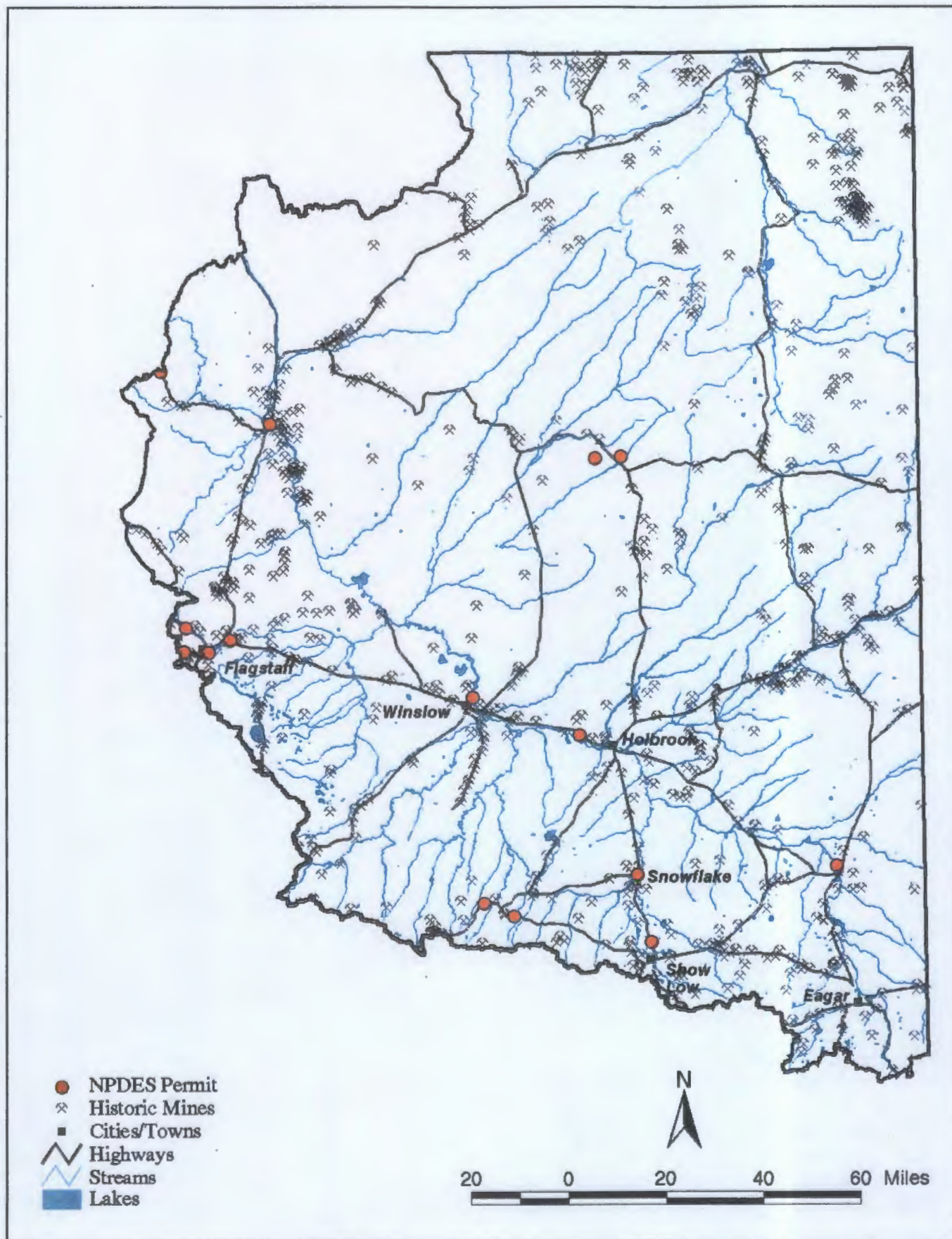


Figure 22. General Land Use and NPDES Permits in the Little Colorado-San Juan Watershed

Little Colorado-San Juan Watershed Assessment Discussion

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 250 stream miles and 2,005 lake acres were assessed. This was a focus watershed in 2001; however, this was outside the data window used for this assessment (1995-2000). That data will be applied to the next assessment.

Water quality assessment information for the Little Colorado-San Juan Watershed is summarized in the following tables and illustrated on **Figure 23**:

Table 12. Assessments in the Little Colorado-San Juan Watershed – 2002

	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	127	9	159	2
INCONCLUSIVE	127	8	1,818	6
IMPAIRED	17	1	0	0
NOT ATTAINING	0	0	111	1
TOTAL ASSESSED	250	16	2,005	7

PERENNIAL SURFACE WATERS ASSESSED	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
Assessed	262	17	2,087	9

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial mileage although part of the reach may have ephemeral or intermittent flow.

Inconclusive Assessments – Surface waters with some monitoring data, but insufficient data to determine if the water is attaining its uses or impaired, were added to the new Planning List. By the end of the next watershed monitoring cycle (scheduled in 2005), ADEQ expects to monitor most of these reaches so that all designated uses can be assessed during the following assessment cycle.

ADEQ also will be working with USGS and the Arizona Game and Fish Department so that future monitoring will better support Arizona's surface water assessments. Other lakes and streams which lack monitoring data will also be monitored depending on resources and priorities.

Major Stressors – When a surface water is listed as impaired or not attaining its designated uses, the pollutants or suspected pollutants causing the impairment are identified. Only one reach is assessed as impaired in this watershed: the Little Colorado River, from Porter Tank Draw to McDonalds Wash. This reach is impaired due to metals (copper and silver). A TMDL investigation is needed to determine the source of these metals and the contribution due to natural sources.

Rainbow Lake is assessed as not attaining its uses due to nutrient loadings causing occasional fish kills. A nutrient TMDL was approved by EPA in 2000 and is currently being implemented. The lake was added to the Planning List, and monitoring is being scheduled to evaluate the effectiveness of the TMDL implementation strategies.

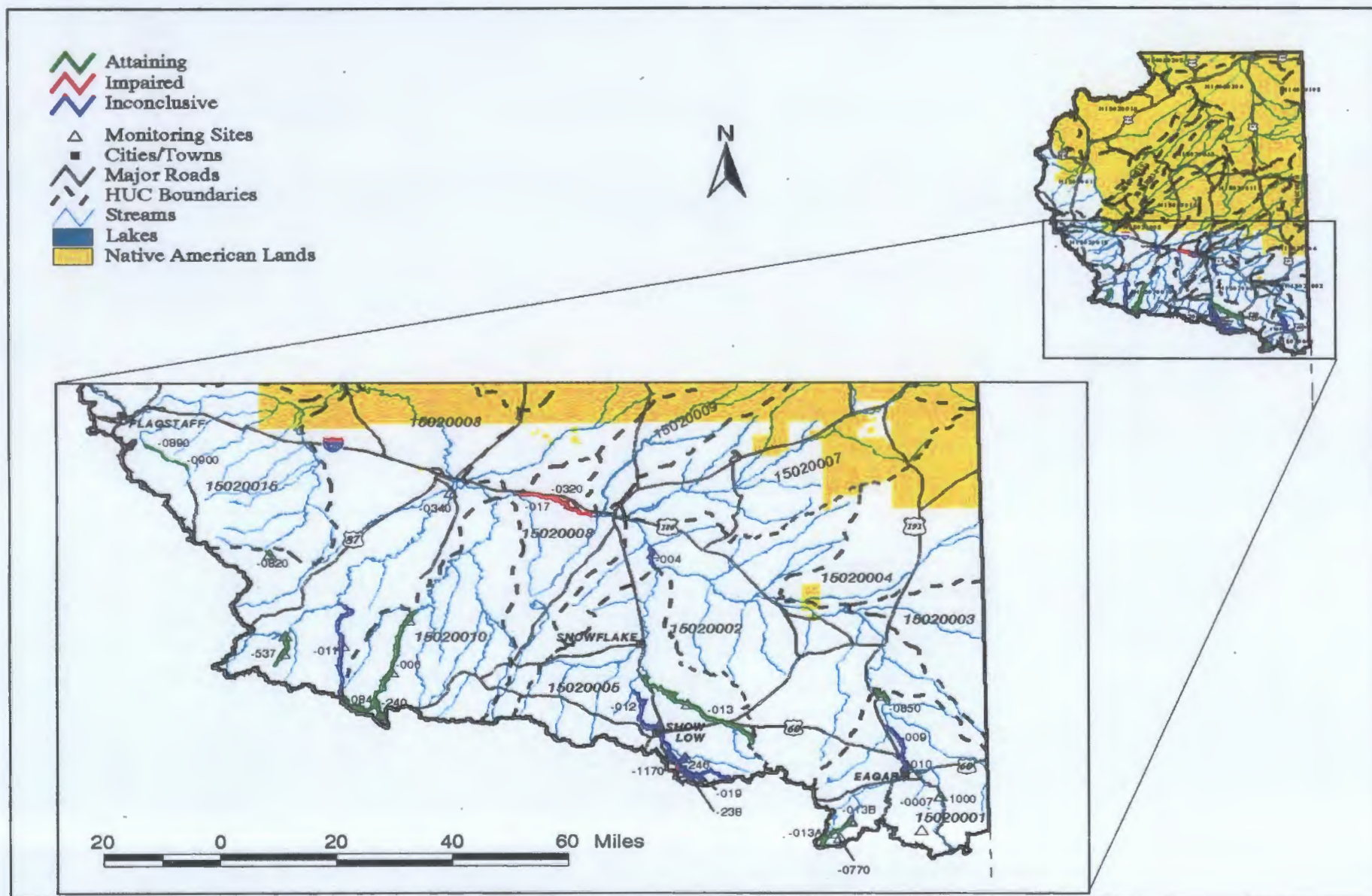


Figure 23. Little Colorado-San Juan Watershed Surface Water Assessments – 2002

TABLE 13. LITTLE COLORADO - SAN JUAN WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY & PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Barbershop Canyon Creek headwaters-East Clear AZ15020008-537 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program East Clear Creek confluence LCBRB000.18 100411	1996 - 1 metals 1997 - 1 suite (few metals)	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.7	1 of 1		Field staff documented that naturally occurring ground water upwelling rather than any anthropogenic activities caused the low dissolved oxygen; therefore, data not considered in the final assessment. Missing Escherichia coli.
	ADEQ Biocriteria Program At Merritt Draw LCBRB003.84 100410	1997 - 1 suite (few metals)	OK					Missing core parameters: Escherichia coli. (Note no historic or current mining in drainage area so metal samples not required.)
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1996-1997 3 samples 2 sampling events Missing core parameters	OK				Inconclusive	ADEQ's Bioassessment Program collected three water chemistry samples in 1996 - 1997. Assessed as "Inconclusive" and placed on the Planning List due to insufficient sampling events and core parameters monitored.
Billy Creek headwaters-Show Low Creek AZ15020005-019 A&Wc, FC, FBC, AgL	AGFD Routine Monitoring At hatchery LCBIL002.81	1997 - 1 suite 1998 - 2 suites	OK					Missing core parameters: turbidity and E. coli. (Note no historic or current mining in drainage area so metal samples not required to assess.)
	Summary Row A&Wc Inconclusive FC Attaining FBC Inconclusive AgL Attaining	1998 3 sampling events Missing core parameters	OK				Attaining	AGFD collected three samples in 1998. Assessed as "attaining some uses" and placed on the Planning List due to insufficient core parameters.
Buck Springs Canyon Creek headwaters-Leonard Canyon AZ15020008-557 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Inside enclosure of cattle and elk LCBCK003.81 100413	1996 - 1 suite	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	3.8	1 of 1		Field staff documented that naturally occurring ground water upwelling rather than any anthropogenic activities caused the low dissolved oxygen; therefore, data not considered in the final assessment.
			pH SU	6.5-9.0 (A&Wc, FBC, AgL)	6.0-6.6	1 of 1		
			Turbidity NTU	10 (A&Wc)	19-27	1 of 1		
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1996 1 sampling event	pH SU	6.5-9.0 (A&Wc, FBC, AgL)	6.0-6.6	1 of 1	Inconclusive	Insufficient monitoring events to assess. Add to Planning List due to pH and turbidity not exceeding standards in one sample.
			Turbidity NTU	10 (A&Wc)	19-27	1 of 1		

TABLE 13. LITTLE COLORADO - SAN JUAN WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY & PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Chevelon Creek headwaters-West Chevelon Creek AZ15020010-006 A&Wc, FC, FBC, Agl, AgL	ADEQ Biocriteria Program At Telephone Ridge LCCHC037.39 100445	1997 - 1 suite	OK					
	AGFD Routine Monitoring @ Chevelon Crossing	1996 - 2 field, nutrients	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.0-8.3	1 of 6		Lacking turbidity, E. coli, boron, and metals
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	1996-1997 3 sampling events Missing core parameters	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.0-8.3	1 of 6	Inconclusive	ADEQ and AGFD collected a total of 3 samples at two sites in 1996-1997. Reach assessed as "Inconclusive" and placed on the Planning List due to insufficient core parameters and dissolved oxygen levels not meeting standards.
Hall Creek headwaters-Little Colorado River AZ15020001-012 A&Wc, FC, FBC, Agl, AgL	AGFD Routine Monitoring @ Arizona Route 273	2000 - 1 field	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.1	1 of 1		
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	2000 1 sampling event	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.1	1 of 1	Inconclusive	Insufficient sampling events to assess any designated uses. Add to the Planning List.
Hart Canyon Creek headwaters-Willow Creek AZ15020008-586 A&Wc, FBC, AgL	AGFD Routine Monitoring @ Vincent Ranch	1996 - 1 field, nutrients	OK					
	Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Little Colorado River West Fork Little Colorado-Water Cyn AZ15020001-011 A&Wc, FC, FBC, Agl, AgL	ADEQ Biocriteria Program Above South Fork LCR LCLCR173.84 100580	1998 - 1 suite	OK					
	Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Little Colorado River Water Canyon-Nutriso AZ15020001-010 A&Wc, FC, FBC, Agl, AgL	ADEQ Fixed Station Network At Highway 60 bridge LCLCR172.97 100333	1996 - 6 suites	Turbidity NTU	10 (A&Wc)	10-38	5 of 6		

TABLE 13. LITTLE COLORADO - SAN JUAN WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY & PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Wc Inconclusive FC Attaining FBC Attaining Agl Attaining AgL Attaining	1996 6 sampling events	Turbidity NTU	10 (A&Wc)	10-38	5 of 6	Inconclusive	ADEQ collected 6 samples in 1996. Reach assessed as "attaining some uses" and was added to the Planning List due to turbidity exceeding standards for further monitoring.
Little Colorado River Nutrioso Creek.-Carr Wash AZ15020001-009 A&Wc, FC, FBC, Agl, AgL	ADEQ Fixed Station Below Springerville WWTP LCLCR172.60 100331	1999 - 2 suites + 1 field, nutrients 2000 - 4 suites	Turbidity NTU	10 (A&Wc)	5-45	5 of 7		
	Summary Row A&Wc Inconclusive FC Attaining FBC Attaining Agl Attaining AgL Attaining	1999-2000 4 sampling events	Turbidity NTU	10 (A&Wc)	5-45	5 of 7	Inconclusive	ADEQ collected 4 samples in 1994-2000. Reach assessed as "attaining some uses" and was added to the Planning List due to turbidity exceeding standards for further monitoring.
Little Colorado River Silver Creek.-Carr Wash AZ15020002-004 A&Ww, FC, FBC, DWS, Agl, AgL	ADEQ Fixed Station Network Near Woodruff LCLCR120.11 100334	1996 - 3 suites + 3 field + 3 nutrients 1999 - 3 suites 2000 - 3 suites	Arsenic (total)	50 (DWS, FBC)	<10 - 67	2 of 12		
			Barium (total) µg/L	2000 (DWS)	170-7,700	1 of 12		
			Beryllium (total) µg/L	0.21 (FC)	1.1-58.2	3 of 3		8 other beryllium samples were not included because Laboratory Reporting Limit was too high
			Beryllium (total) µg/L	4 (FBC)	<0.5-58.2	2 of 12		
			Chromium (total) µg/L	100 (DWS)	<10-200	1 of 16		
			Escherichia coli CFU/100 ml	580 (FBC)	30- 57,000	1 of 7		
			Fecal coliform CFU/100 ml	4,000 (DWS, A & Ww, Agl, AgL)	10 - 26,000	1 of 7		
			Lead (total) µg/L	50 (DWS)	<5-371	2 of 12		
			Lead (total) µg/L	100 (Agl)	<5-371	2 of 12		
			Manganese (total) µg/L	4,900 (DWS)	<50-9,800	2 of 12		
			Nickel (total) µg/L	100 (DWS)	<100-320	2 of 12		

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY & PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	Reach Summary A&Ww Inconclusive FC Attaining FBC Inconclusive DWS Inconclusive AgI Inconclusive AgL Inconclusive	1998-2000 12 sampling events.	Turbidity NTU	50 (A&Ww)	30 - 1,000	8 of 11		ADEQ collected 12 samples in 1998-2000. Reach is assessed as "attaining some uses" and was added to the Planning List due to beryllium, turbidity, and bacteria exceedances of standards.
			Arsenic (total) µg/L	50 (DWS, FBC)	<10 - 67	2 of 12	Attaining	
			Barium (total) µg/L	2000 (DWS)	170-7,700	1 of 12	Attaining	
			Beryllium (total) µg/L	0.21 (FC)	1.1 - 58.2	3 of 3	Inconclusive	
			Beryllium (total) µg/L	4 (FBC)	<0.5-58.2	2 of 12	Attaining	
			Chromium (total) µg/L	100 (DWS)	<10-200	1 of 16	Attaining	
			Escherichia coli CFU/100 ml	580 (FBC)	30 - 57,000	1 of 7	Inconclusive	
			Fecal coliform CFU/100 ml	4,000 (DWS, A&Ww, AgI, AgL)	10 - 28,000	1 of 7	Inconclusive	
			Lead (total) µg/L	50 (DWS)	<5-371	2 of 12	Attaining	
			Lead (total) µg/L	100 (AgL)	<5-371	2 of 12	Attaining	
			Manganese (total) µg/L	4,900 (DWS)	<50-9,800	2 of 12	Attaining	
			Nickel (total) µg/L	100 (DWS)	<100-320	2 of 12	Attaining	
			Turbidity NTU	50 (A&Ww)	30 - 1,000	7 of 12	Inconclusive	
Little Colorado River Lyman Lake - unnamed tributary (14 miles) AZ15020002-024 A&Ww, FC, FBC, DWS, AgI, AgL	AGFD Routine Monitoring At Wenima LCLCR158.36	2000 - 1 suite	OK					
	Summary Row	2000 1 sampling event	OK				Not assessed	Insufficient data to assess.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Mamie Creek headwaters-Coyote Creek AZ15020001-351 A&Wc, FC, FBC, Agl, AgL	ADEQ Biocriteria Program Below Forest Road 275 LCMAM001.73 100589	1996 - 1 suite	OK					
	Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess
Milky Creek headwaters-Nutrios Creek AZ15020001-309 A&Wc, FC, FBC	AGFD Routine monitoring Off Nutrios Creek	1996 - 1 field, nutrients	OK					
	Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Mineral Creek headwaters-Concho AZ15020002-648 A&Wc, FC, FBC, Agl, AgL	ADEQ Biocriteria Program Above Forest Road #404 LCMIN014.01 100593	1996 - 1 suite	OK					
	Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess
Porter Creek headwaters-Show Low Creek AZ15020005-246 A&Wc, FC, FBC	AGFD Routine Monitoring Above Scott Reservoir LCPRT001.17	1997 - 1 field, nutrients 1998 - 2 field, nutrients	OK					Lack core parameters: turbidity and E. coli. (No historic or current mining in the drainage area, so metals are not required.)
	Summary Row A&Wc Inconclusive FC Attaining FBC Inconclusive	1997-1998 3 sampling events Missing core parameters	OK				Attaining	AGFD collected 3 samples in 1997-1998. Reach assessed as "attaining some uses" and was placed on the Planning List due to missing core parameters.
Rudd Creek headwaters-Nutrios Creek AZ15020001-026 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Above Benton Creek LCRUD005.17 100634	1996 - 1 suite	OK					
	Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess
Show Low Creek headwaters-Linden Wash AZ15020005-012 A&Wc, FC, FBC, Agl, AgL	AGFD Routine Monitoring Above Fools Hollow and below Silver Creek LCSHL010.47	1997 - 1 field, nutrients, metals 1998 - 2 field, nutrients, metals	OK					Lacking core parameters: turbidity, E. coli, and boron. (No current or historic mining in the drainage area so metals are not required).

TABLE 13. LITTLE COLORADO - SAN JUAN WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY & PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	AGFD Routine Monitoring Above Show Low Lake	1997 - 1 field, nutrients 1998 - 2 field, nutrients	OK					
	Summary Row	1997-1998	OK				Attaining	AGFD collected 6 samples during 1997-1998. Reach assessed as "attaining some uses" and was placed on the Planning List due to missing core parameters.
	A&Wc Inconclusive	6 samples						
	FC Attaining	3 sampling events						
Sliver Creek headwaters-Show Low Creek AZ15020005-013 A&Wc, FC, FBC, Agl, AgL	AGFD Routine Monitoring @ Spring	1997 - 1 field, nutrients 1998 - 2 field, nutrients 2000 - 1 suite	OK					Missing core parameters: turbidity, E. coli, boron, metals
	AGFD Routine Monitoring @ Rock House	1997 - 1 field, nutrients 1998 - 2 field, nutrients,	OK					
	AGFD Routine Monitoring @ Upper Springs	2000 - 1 field, nutrients, metals	OK					
	AGFD Routine Monitoring @ U2 Outflow	2000 - 1 field, nutrients, metals	OK					
	AGFD Routine Monitoring @ U3 Outflow	2000 - 1 field, nutrients, metals	OK					
	Summary Row	2000	OK				Inconclusive	AGFD collected a total of 10 samples at 5 sites in 1997-2000. Reach assessed as "Inconclusive" and was placed on the Planning List because of missing core parameters.
	A&Wc Inconclusive	10 samples						
South Fork Little Colorado River headwaters-Little Colorado River AZ15020001-027 A&Wc, FC, FBC, Agl, AgL	ADEQ Biocriteria Program Above So Fork Campground LCSLR001.29 100644	1998 - 1 suite	OK					
	Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Walnut Creek Pine Lake-Rainbow Lake AZ15020005-238 A&Wc, FC, FBC, Agl, AgL	AGFD Routine Monitoring	1997 - 1 field, nutrients, metals 1998 - 2 field, nutrients, 1 metals	OK					Lacking core parameters: turbidity, E. coli, and boron. (No current or historic mining in the drainage area, so metals not required.)

TABLE 13. LITTLE COLORADO - SAN JUAN WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY & PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row	1997-1998	OK				Attaining	AGFD collected a total of 3 samples in 1997-1998. Reach assessed as "attaining some uses" and was placed on the Planning List due to missing core parameters.
	A&Wc Inconclusive FC Attaining FBC Inconclusive AgL Inconclusive	3 samples Missing core parameters						
West Fork Little Colorado River headwaters- Government Springs AZ15020001-013A A&Wc, FC, FBC	ADEQ Biocriteria Program Mount Baldy Wilderness LCWLR004.09 100694	1998 - 1 suite	OK					
	ADEQ Biocriteria Program Above Government Springs LCWLR001.08 100695	1998 - 1 suite	OK					
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive	1998 2 samples 1 sampling event	OK				Inconclusive	ADEQ collected a total of 1 samples at 2 sites in 1998. Reach assessed as "Inconclusive" and was placed on the Planning List due to insufficient sampling events.
West Fork Little Colorado River Gov't Springs-Little Colorado River AZ15020001-013B A&Wc, FC, FBC, AgL, AgL	ADEQ Fixed Station Network At Government Springs LCWLR000.78 100328	1996 - 6 suites 1999 - 4 suites 2000 - 4 suites	Dissolved oxygen mg/L	7.0 mg/L (90% saturation) (A&Wc)	5.0 - 8.7 (80.0 - 97.3 %)	3 of 12		Field staff documented that naturally occurring ground water upwelling rather than any anthropogenic activities caused the low dissolved oxygen; therefore, data not considered in the final assessment.
	Summary Row A&Wc Attaining FC Attaining FBC Attaining AgL Attaining AgL Attaining	1996-2000 14 sampling events	OK				Attaining	ADEQ collected 14 samples between 1996-2000. Reach assessed as "attaining all uses."
Willow Creek headwaters-East Clear Creek AZ15020008-011 A&Wc, FC, FBC, AgL	AGFD Routine Monitoring @ Wiggins Crossing LCWLS	1997 - 1 field, nutrients, metals 1998 - 2 field, nutrients, metals	OK					Missing core parameters: turbidity, E. coli, dissolved metals, flow, arsenic, beryllium, mercury, manganese.
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgL Attaining	1997-1998 3 sampling events Missing core parameters	OK				Attaining	AGFD collected 3 samples in 1997-1998. Reach assessed as "attaining some uses" and was placed on the Planning List due to missing core parameters.
Willow Spring Creek headwaters-Chevelon Creek AZ15020010-240 A&Wc, FC, FBC, AgL	AGFD Routine Monitoring Below dam LCWLS003.26	1996 - 2 field, nutrients	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	1.6-5.86	2 of 2		Missing core parameters: turbidity and E. coli. No mining; therefore metals not required.

TABLE 13. LITTLE COLORADO - SAN JUAN WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY & PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row	1996	OK				Inconclusive	AGFD collected three samples in 1996. Reach assessed as "Inconclusive" and was placed on the Planning List due to insufficient monitoring events and core parameters.
	A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	2 sampling events Missing core parameters						
Woods Canyon Creek headwaters-Chevelon Creek AZ15020010-084 A&Wc, FC, FBC, AgL	AGFD Routine Monitoring below dam	1996 - 2 field	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.6-6.9	1 of 2		Missing most core parameters.
	Summary Row	1996	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.6-6.9	1 of 2	Inconclusive	AGFD collected two field samples in 1996. Reach assessed as "Inconclusive" and was placed on the Planning List due to insufficient monitoring events and core parameters.
	A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	2 samples Missing core parameters						
LAKE MONITORING DATA								
Clear Creek Reservoir AZL15020008-0340 A&Wc, FC, FBC, DWS, AgL, AgL	AGFD Routine Monitoring 2 sites LCCCR	1999 - 2 field, nutrients, metals 2000 - 1 field, nutrients, metals						Lack core parameters: turbidity, E. coli, dissolved chromium, beryllium, arsenic fluoride, and barium. Mercury's method detection limit is not low enough to assess Fish Consumption.
	Summary Row	1999-2000	OK				Attaining	AGFD collected 3 samples in 1999-2000. Lake assessed as "attaining some uses," and was placed on the Planning List due to missing core parameters.
	A&Wc Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive AgL Inconclusive AgL Attaining	3 sampling events Missing core parameters						
Cholla Lake AZL15020008-0320 A&Ww, FC, FBC, AgL	AGFD Routine Monitoring 2 sites LCCHO	1999 - 3 field, nutrients, metals 2000 - 1 field, nutrients, metals	OK					Lack core parameters: turbidity, E. coli, arsenic, and beryllium. Mercury's method detection limit is not low enough to assess Fish Consumption.
	Summary Row	1999-2000	OK				Attaining	AGFD collected 4 samples in 1999-2000. Lake assessed as "attaining some uses," and was placed on the Planning List due to missing core parameters.
	A&Wc Inconclusive FC Attaining FBC Inconclusive AgL Attaining	4 sampling events Missing core parameters						
Lee Valley Reservoir AZL15020001-0770 A&Wc, FC, FBC, AgL, AgL	AGFD Routine Monitoring LCLEE	1997 - 1 field, nutrients 1998 - 2 field, nutrients 1999 - 1 field, nutrients	pH SU	6.5-9.0 (A&Wc, FBC, AgL) 4.5-9.0 (AgL)	6.3-10.0	2 of 4		Lack of core parameters: turbidity, E. coli, and boron. No mining in the drainage, so metals not required.
	Summary Row	1997-1999	pH SU	6.5-9.0 (A&Wc, FBC, AgL) 4.5-9.0 (AgL)	6.3-10.0	2 of 4	Inconclusive	AGFD collected 4 samples in 1997-1999. Lake assessed as "Inconclusive" and was placed on the Planning List due to missing core parameters and pH exceedances.
	A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive AgL Inconclusive	4 sampling events Missing core parameters						

TABLE 13. LITTLE COLORADO - SAN JUAN WATERSHED - MONITORING DATA - 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY & PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Long Lake (lower) AZL15020008-0820 A&Wc, FC, FBC, Agl, AgL	AGFD Routine Monitoring 2 sites LCLLL	1998 - 3 field, nutrients	OK					Lack of core parameter coverage: turbidity, E. coli, and boron. Lack of seasonal coverage (sampled only in summer months.) No historic or current mining in the drainage area so metals not required.
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	1998 3 sampling events Missing core parameters and seasonal coverage	OK				Inconclusive	AGFD collected 3 samples in 1998. Lake assessed as "Inconclusive" and was placed on the Planning List due to missing core parameters and seasonal coverage.
Lyman Lake AZL15020001-0850 A&Wc, FC, FBC, Agl, AgL	AGFD Routine Monitoring LCLYM	1997 - 1 field + 2 nutrients, metals 1998 - 1 nutrients	OK					Lack core parameter coverage: turbidity, E. coli, and boron. Lack of seasonal coverage (sampled only in summer months.) No historic or current mining in the drainage area so metals not required.
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	1997-1998 3 sampling events Missing core parameters and seasonal coverage	OK				Inconclusive	AGFD collected 3 samples in 1997-1998. Lake assessed as "Inconclusive" and placed on the Planning List due to missing core parameters and seasonal coverage.
McKay Reservoir AZL15020001-0007 A&Wc, FC, FBC, Agl, AgL	AGFD Routine Monitoring LCMCK	1996 - 1 field	pH	6.5-9.0	9.4	1 of 1		
			SU	(A&Wc, FBC, Agl, AgL)				
	Summary Row	1996 1 sampling event	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	2	1 of 1	Not assessed	Insufficient data to assess. Added to the Planning List due to exceedances.
			pH SU	6.5-9.0 (A&Wc, FBC, Agl, AgL)	9.4	1 of 1		

TABLE 13. LITTLE COLORADO - SAN JUAN WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY & PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Nelson Reservoir AZL15020001-1000 A&Wc FC, FBC, Agl, AgL	AGFD Routine Monitoring LCNEL	1997 - 1 field, nutrients 1998 - 1 field, nutrients						Lacking core parameters: turbidity, E. coli, and boron. No historic or current mining in the drainage, so metals not required.
	Summary Row	1996 - 1998 2 sampling events Missing core parameters	OK				Inconclusive	AGFD collected 2 samples 1996-1998. Lake assessed as "Inconclusive" and added to the Planning List due to insufficient samples and core parameters.
	A&Wc Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive							
Pinetop Hatchery AZL15020005-012 A&Wc, FBC, FC, Agl, AgL	AGFD Routine Monitoring LCPIN	1996 - 1 field, nutrients, metals	OK					
	Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Woods Canyon Lake AZL15020010-1700 A&Wc, FC, FBC, DWS, Agl, AgL	ADEQ Clean Lakes Program LCWCL	1996 - 1 suite	pH (low) SU	6.5-9.0 (A&Wc, FBC, AgL)	6.0-7.1	1 of 1		Low pH in hypolimnion of lake.
	Summary Row	1996 1 sampling event	pH (low) SU	6.5-9.0 (A&Wc, FBC, AgL)	6.0-7.1	1 of 1	Not assessed	Insufficient data to assess.

Information for interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from combining the following: AZ (for streams) or AZL (for lakes) + a US Geological Survey Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses," "Agency," and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year" is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
 - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among the many monitoring entities that provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
 - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
 - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."
 - Although many parameters may be analyzed, only those exceeding a standard are shown. Other parameters were collected.
 - "OK" indicates that no standards were exceeded.
 - The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
 - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
 - A mean, geometric mean, or median will be shown along with the range of results if applicable to the standard or assessment criteria.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or "Inconclusive." See assessment criteria in Chapter III of Volume I.

Ground Water Assessments in the Little Colorado-San Juan Watershed

Major Ground Water Stressors – Monitoring data collected from wells in this watershed between October 1995 - October 2000 are summarized in **Table 14** and illustrated in **Figures 24, 25, and 26**. Of the 38 wells monitored, no wells exceeded Aquifer Water Quality Standards. This is a very small number of wells for this large area (**Figure 24**)

TDS Concentrations – Water quality can be characterized based on concentrations of Total Dissolved Solids (TDS) (**Figure 25**). Elevated salinity may limit practical uses of ground water in some areas as TDS over 500 mg/L has an off-flavor (6 of the 21 wells sampled)) and TDS over 1000 mg/L will limit its use for some crops (2 of 21 wells sampled).

Due to salt deposits, salinity can be naturally very high in ground water. Human activities such as mining, irrigated agriculture, and even wastewater disposal practices can also raise the natural level of salinity in ground water.

No TDS water quality standards apply in this watershed, and the elevated levels of TDS do not present a human-health concern for drinking water. The TDS concentration is only used to generally characterize water quality.

Nitrate Concentrations – Water quality can also be characterized by looking at the concentration of nitrates in ground water (**Figure 26**). In Arizona, naturally occurring nitrate concentrations in ground water are generally below 3 mg/L and concentrations above 5 mg/L may indicate potential anthropogenic sources of nitrate. Among the 36 wells monitored, all nitrate concentrations were below 5 mg/L, indicating high quality water.

When a nitrate concentration exceeds 10 mg/L, Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health, as water with nitrate greater than 10 mg/L may present a health problem for babies and should not be consumed by nursing mothers. No wells exceeded this standard in this watershed; however, efforts should be made to minimize further contamination of ground water by nitrates.

Table 14. Little Colorado-San Juan Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	2		0	0%
	Fluoride	3		0	0%
	Metals/Metalloids	3		0	0%
	Nitrate	3		0	0%
	VOCs + SVOCs*	0	-	-	-
	Pesticides	0	-	-	-
TARGETED MONITORING WELLS	Radiochemicals	13		0	0%
	Fluoride	31		0	0%
	Metals/metalloids	32		0	0%
	Nitrate	33		0	0%
	VOCs + SVOCs*	3	0	0	0%
	Pesticides	3	0	0	0%

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells (all targeted wells)	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
21	15	4	1	1

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells (only 3 index wells)	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
36	36	0	0

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.

The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

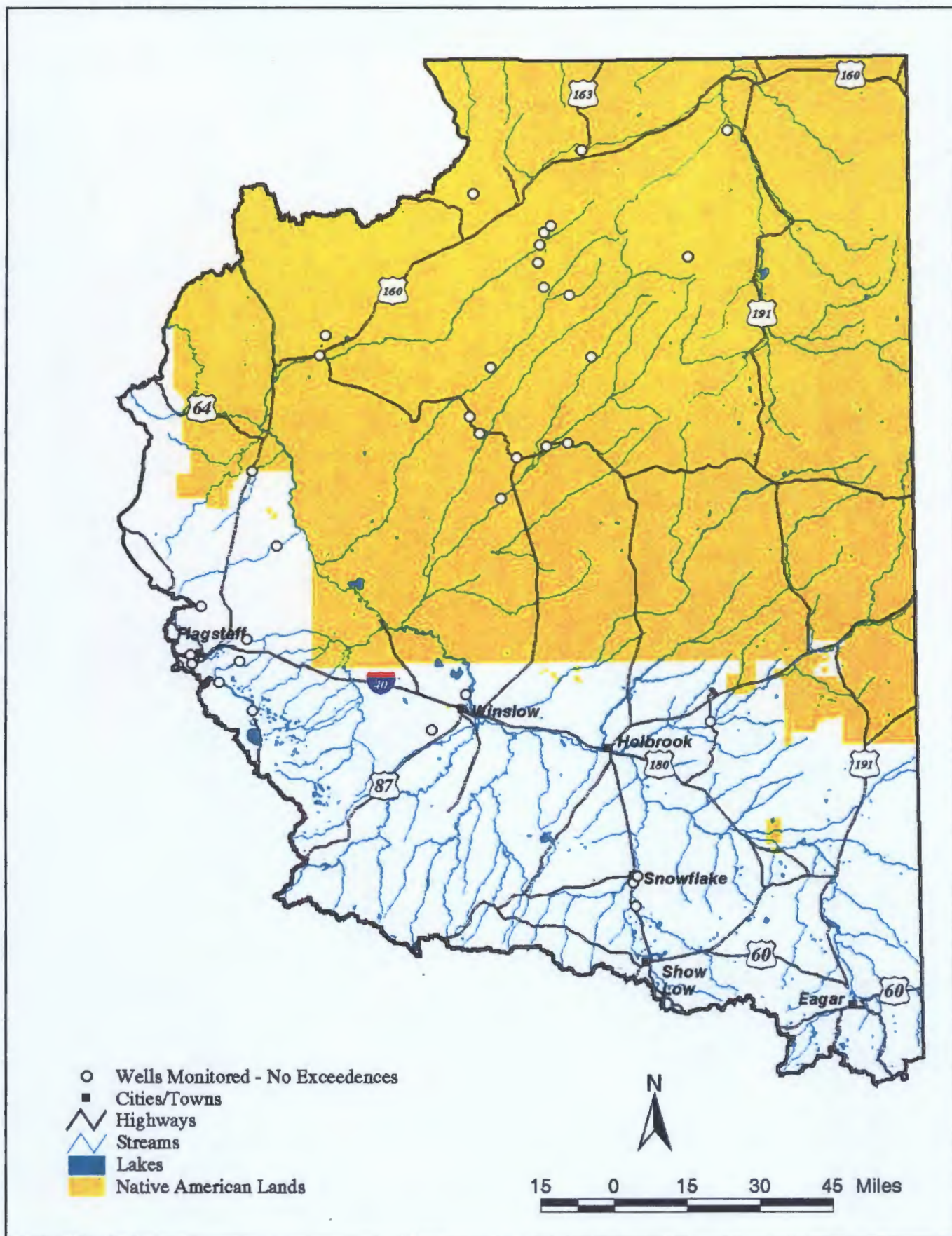


Figure 24. Ground Water Monitoring in the Little Colorado-San Juan Watershed – 1996-2000

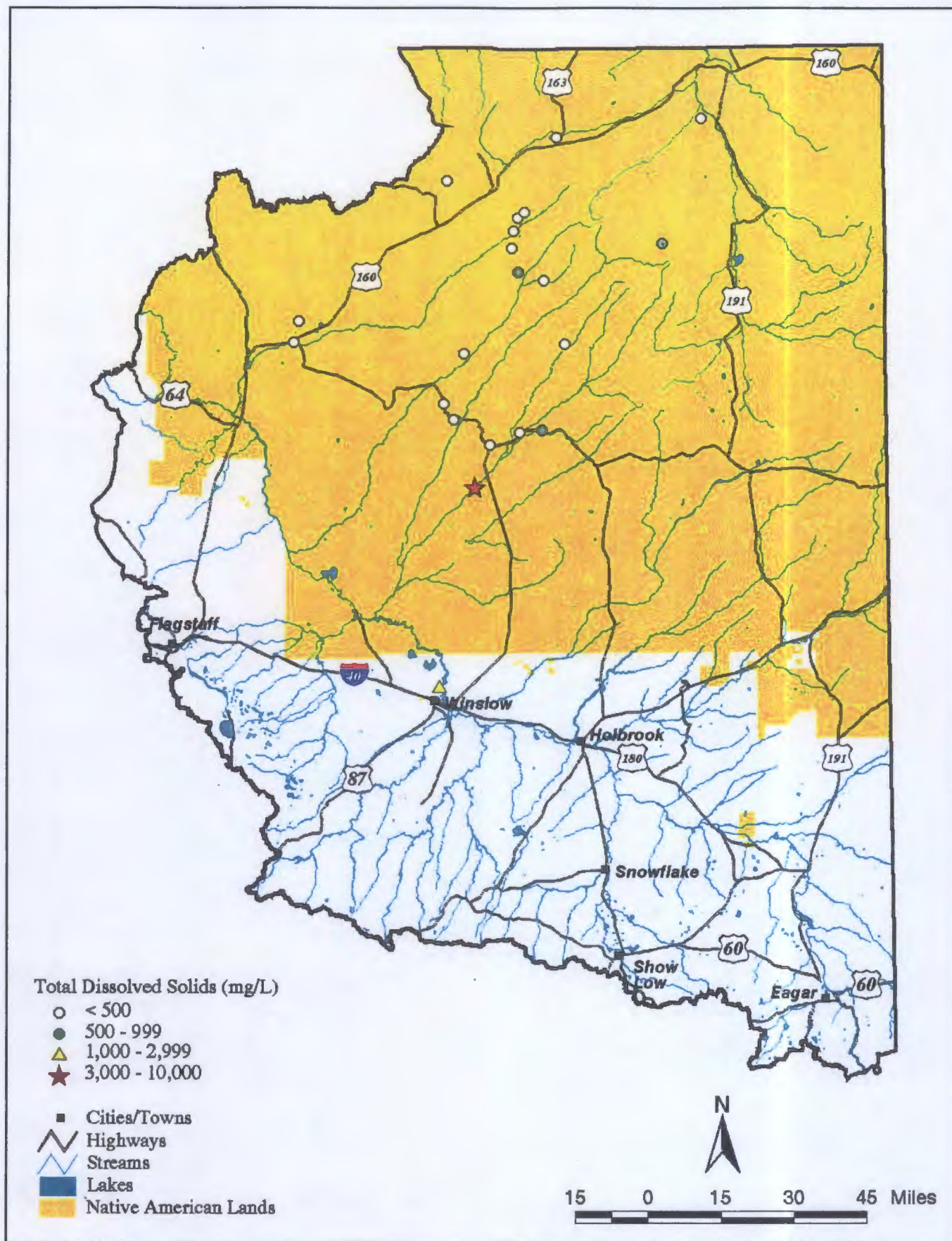


Figure 25. Ground Water by TDS Concentration in the Little Colorado-San Juan Watershed

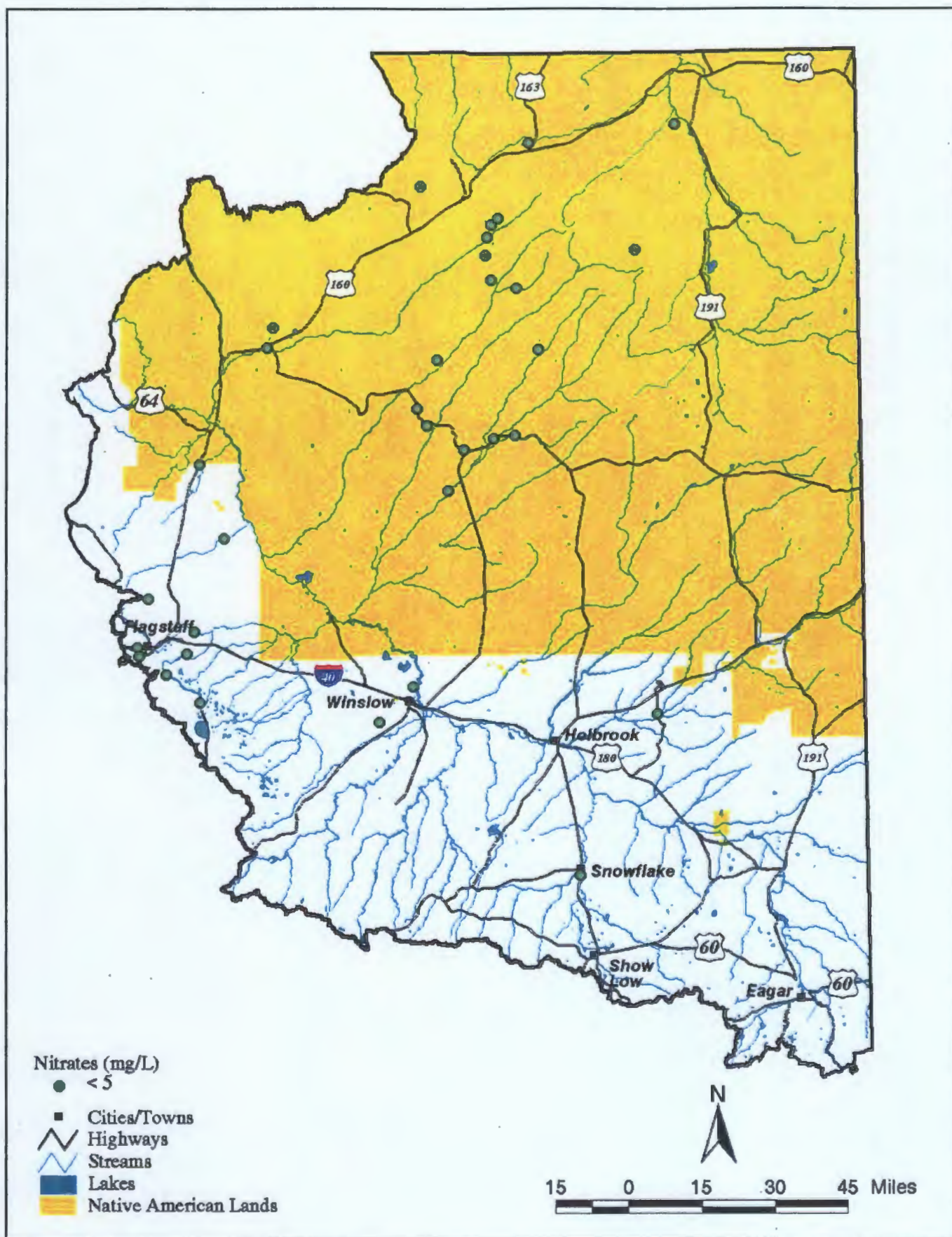


Figure 26. Ground Water Quality by Nitrate Concentrations in the Little Colorado-San Juan Watershed

Watershed Studies and Alternative Solutions In the Little Colorado - San Juan Watershed

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Little Colorado-San Juan Watershed. Watershed partnerships active in this watershed are also mentioned.

Surface Water Studies and Mitigation Projects

Total Maximum Daily Load Analyses – The following TMDL analyses have been completed or are ongoing in this watershed. Further information about the status of these investigations can be obtained by contacting the TMDL Program manager at (602) 771-4468, or at ADEQ's web site:

<http://www.adeq.state.az.us/environ/water/assess/tmdl.html>

- ▶ **Nutriosio Creek TMDL** – In 2000, EPA approved a Total Maximum Daily Load analysis on Nutriosio Creek for turbidity completed by ADEQ. The study determined that a seven mile section, extending from approximately two miles north of the Town of Nutriosio to Nelson Reservoir, violated the current turbidity standard of 10 NTU. Field investigations indicate that entrenchment and increased turbidity levels occurred primarily due to historic grazing and forestry practices in the watershed. Historic and current ungulate grazing has contributed to a loss of riparian vegetation which would help stabilize banks, dissipate stream energy, and slow stream velocities. The entrenchment of the stream caused a loss of flood plain, which leads to further increased stream velocity and related shear stress at bankfull and higher flows. The soils are primarily composed of a silty organic clay which are highly susceptible to waterborne erosion, freeze-thaw erosion, and wind erosion.

The target load capacity for Nutriosio Creek to meet water quality standards during critical spring flows was calculated to be 183 pounds per day as total suspended solids (TSS), while the measured load was estimated to be 1020 pounds per day. Therefore, the load reduction was calculated to be 837 pounds of TSS per day. During average base flow conditions no load reduction is necessary as no violations occur.

As turbidity impairment is correlated with increased flows in critical spring flow events, implementation projects and best management practices were designed reduce stream water velocities during these higher flows, and thereby, decrease sediment loads from sheet flow and wind erosion. A variety of Best Management Practices (BMPs) and other possible projects were identified in the TMDL, including:

- ▶ Limiting cattle grazing in the riparian corridor to only the dormant winter months to encourage a diversity of emergent plants in the spring.
- ▶ Reduced timber cutting on US Forest Service lands;
- ▶ Close 40 miles of roads on US Forest Service lands (completed 1999);
- ▶ Adjust cattle entry times and balance the number of cattle with the allowable use by 2005;
- ▶ Establish cattle and wildlife exclosures where overgrazing has been a problem during critical growing periods;
- ▶ Install stream grade stabilization structures to protect at risk banks during high critical flow events;
- ▶ Encourage off-channel cattle and wildlife drinking facilities to allow more water to remain in the stream and allow the riparian corridor to encourage revegetation;
- ▶ Revegetate riparian corridors with willow planting and grasses using a critical Area Planing method outlined by the Natural Resources Conservation Service guidance.

- **Rainbow Lake TMDL** – In 2000, EPA approved the Rainbow Lake nutrient TMDL for Rainbow Lake. Based on nutrient load reductions and projections for associated indicators, the standards for pH, ammonia toxicity, and narrative nutrients will be achieved.

Within the Rainbow Lake watershed there are no permitted point sources on nutrients; therefore, non-point sources must be controlled to eliminate harmful eutrophic conditions in Rainbow Lake. Several nonpoint sources of nutrients were identified: septic systems, ground water, decomposition of aquatic plants, and runoff from residential, commercial, agricultural, forests, and barren land. Based on historic nutrient budgets the following load reductions from non-point sources

are needed to achieve water quality standards (non-dredging option):

Nitrogen Reduction

residential runoff – 50%

macrophyte decomposition – 50%

septic systems – 75%

Phosphorus Reduction

residential runoff – 50%

macrophyte decomposition 50%

Implementation options were discussed in the TMDL. ADEQ recommended a strong monitoring effort in the lake and its tributaries to gauge the success of implemented strategies.

- Little Colorado River TMDL – ADEQ issued a draft turbidity TMDL for two segments of the upper Little Colorado River near Springerville, Arizona in May 2002. Investigations indicate that turbidity impairment actually starts upstream of these segments and that the main cause of turbidity is loss of vegetative cover due to historic and current grazing practices. The loss of vegetation, especially in the riparian area, allows increase runoff, soil erosion, and bank destabilization. Turbidity impairment appears to be correlated with larger flow events during winter-spring rain and snow melt and summer-fall monsoon rains. TMDL values were established for each season because of differences in flow regimes.

Turbidity is a measurement of light traveling through water. A loading cannot be calculated directly for this water quality standards; therefore, total suspended solids (TSS) were correlated to turbidity standards and measurements and were used to develop TSS load reductions.

Winter-spring : * At 29 cfs flow

TMDL = 1,702 pounds/day TSS

Load reduction 5,257 pounds/day TSS

Summer-Fall: * At 13 cfs flow

TMDL = 681 pounds/day TSS

Load reduction = 1,828 pounds/day TSS

Implementation projects and best management practices should be aimed at decreasing the contributions of sediment during higher flow events. Effective methods include increasing riparian vegetation, stream bank stabilization, maintenance of flood plains, and minimization of the impact of cattle in the general area.

Information about the status of this TMDL and opportunities for public involvement can be found at ADEQ's web site:

<http://www.adeq.state.az.us>.

Water Protection Fund projects – The following Water Protection Funds projects have been awarded grants by the Arizona Department of Water Resources.

- Saffell Canyon and Murray Basin (Sub-)Watershed Restoration Project – Apache Sitgreaves National Forest received this grant to restore watershed health and improve water quality in these drainage areas by reducing and reversing soil erosion in the watershed. The Murray Basin and Saffell Canyon had been severely damaged by past management practices. Project was completed in 1998.
- Hoxworth Springs Riparian Restoration Project – Scientists at Northern Arizona University are working with the Coronado National Forest to restore the historic stream channel to a portion of a perennial stream that flows from Hoxworth Springs. The stream has experienced downcutting and a significant loss of riparian vegetation due to channelization and intense grazing from livestock and elk. Channel stabilization is to be accomplished using earth moving equipment and revegetation. Elk exclosures were constructed to reduce grazing pressure during restoration efforts. This project was completed in 1999.
- Highpoint Well Project – Navajo County Natural Resource Conservation District developed 24 water troughs and 3.5 miles of cross fencing to more evenly distribute grazing by livestock and wildlife (ungulates). The objective is to improve vegetative cover; thereby reducing erosion and sediment deposition in both Chevelon Creek and Clear Creek, which are perennial tributaries to the Little Colorado River. This project was completed in 1999.
- Talastima (Blue Canyon) Sub-watershed Restoration Project – The Hopi Tribe received funds to restore the Talastima subwatershed, which contains almost 8,000 acres with 19 miles of stream and wetlands on the Hopi lands. Restoration measures included:

- ▶ A tamarisk and Russian olive tree removal demonstration project,
- ▶ Revegetation of native wetland and riparian species,
- ▶ Erosion control using straw bales,
- ▶ Completing livestock exclosures with fencing,
- ▶ Installation of a monitoring well and seven drive-point wells,
- ▶ A study of road impacts on riparian health.

Monitoring was conducted using on-the-ground data collection combined with remote sensing techniques to evaluate the success of tamarisk and Russian olive removal and revegetation to improve ground water levels, surface water flows, water quality, and migratory bird habitat. This project was completed in 2001

- ▶ Tsaile Creek (Sub-)Watershed Restoration Demonstration – The Navajo Nation received a grant to develop six watershed restoration projects with concurrent workshops to demonstrate riparian restoration concepts to local residents, tribal employees, and resource conservation professionals. The projects focused on biological restoration approaches and was completed in July 2000.
- ▶ Demonstration Enhancement of Pueblo Colorado Wash at Hubbell Trading Post – The National Park Service (Hubbell Trading Post National Historic Site) was funded to re-establish, enhance and conserve one-half mile of the Pueblo Colorado Wash within the boundaries of this historic site. The stream channel was restored using low-tech instream structures to restore meanders and pools. This should slow stream flows so that sediment is deposited in point bars that will eventually support riparian vegetation. Invasive plant species were removed from the riparian area. The stream channel and riparian areas were revegetated with appropriate native species such as native reed, willows and cottonwoods. Restoration efforts and water quantity were evaluated to determine changes that result from project activities. Hydro-meteorological monitoring was conducted to establish hydrological baseline data for the wash. The project was completed in 2001.
- EC Bar Ranch Water Well Project – James Crosswhite, a rancher, received funds to develop an alternative water source for livestock and wildlife in order to eliminate the need for the animals to utilize a water

gap in the fenced section of Nutrioso Creek, a degraded perennial stream. This objective will be met through the drilling of two water wells, installation of solar pumps, and distribution of water to tanks. The project is to be completed in 2002.

- EC Bar Ranch Wildlife Drinker Project – Funds were also provided to James Crosswhite to establish four wildlife (elk) drinking water sources along the west and east sides of Nutrioso Creek in order to deter elk from using the creek and impacting the riparian vegetation. Livestock management of the area has recently been improved by the addition of upland water sources and livestock fencing. Livestock will continue to use the riparian area under a management plan formulated in conjunction of the Natural Resources Conservation Service. Project funding will be used to purchase and install conveyance pipe, drinkers, and more at four sites with water to be provided from a well previously developed using Water Protection Funds. The project is to be completed in 2003.
- Watershed restoration of a High Elevation Riparian Community – This project, conducted by Northern Arizona University, is to increase and sustain water flows into the unhealthy down slope riparian community at Hart Prairie in Northern Arizona. Previous riparian restoration work at this site improved moisture conditions by successfully increasing surface discharge and ground water storage; however, monitoring results indicate incomplete recovery due to up slope watershed conditions. The following work is aimed at improving water flows:
 - ▶ Reduce the density of pines encroaching the wet meadow by tree thinning and prescribed burns,
 - ▶ Construct fencing to manage grazing of large ungulates,
 - ▶ Reduce or eliminate stock tanks,
 - ▶ Restore stream channels in the upland watershed,
 - ▶ Continue and expand monitoring of the watershed vegetation, stream flow, and fluvial geomorphology.
- Pressure Irrigation Feasibility Study and Preliminary Design – The Town of Eager and Round Valley Water Users Association received funds to conduct a feasibility study and preliminary design for making improvements to the irrigation system. Improvements to the irrigation system can potentially enhance the water quality and quantity of water

in storage. Irrigation water is currently delivered through unlined open ditch canals, and extremely high water losses occur through percolation. These losses result in more water being diverted from the Little Colorado River. This study identified the extent of the water loss in the current irrigation ditch and canal system, and provided a preliminary design for the most feasible methods to resolve these water losses. Implementation of potential recommendations from this study could enhance riparian habitats along the Colorado River. (An ADEQ Water Quality Improvement Grant was also awarded to pipe the first five miles of the Big Ditch.) This project was completed in 2001.

- Little Colorado River Enhancement Demonstration Project – The Apache Natural Resources Conservation District was awarded funds to develop a site-specific concept plan and construct a river restoration demonstration project on a reach of the upper Little Colorado River on private land. The project will incorporate a natural channel approach that will demonstrate an effective means for restoring a destabilized stream channel. The Upper Little Colorado River Partnership hopes to establish a demonstration project that will educate other landowners and natural resource managers about stream and riparian restoration techniques. This restoration project will be used as an outdoor classroom for looking at aquatic and riparian systems, biology, and domestic livestock and wildlife interactions. The project is to be completed by 2003.
- Little Colorado River Riparian Restoration Project -- The Pueblo of Zuni seeks to restore a working riparian area and wetland ecosystem along the Little Colorado River in Hunt Valley. The project would involve testing and reconditions an existing well and constructing a pipeline to an area that would restore three wetlands and 80 acres of riparian habitat. The tribe is committed to maintaining the project in perpetuity and has obtained matching funding from the US Bureau of Reclamation and the US EPA for monitoring efforts. This project is to be completed by 2003.
- Brown Creek Riparian Restoration – Apache-Sitgreaves National Forest Lakeside Ranger District received funds to establish one livestock watering facility, create a baseline inventory, and monitor a perennial segment of Brown Creek. The project area includes the spring and 1.5 miles of the upper portion of Brown Creek, one of a few perennial

streams in this district.

Water Quality Improvement Grant Projects – ADEQ awarded the following Water Quality Improvement Grants (319h Grants) in this watershed.

- EC Bar Ranch Turbidity Reduction Project – Phase I and II – Jim Crosswhite, a private rancher, is to demonstrate the effectiveness of various practices recommended in the Nutrioso turbidity TMDL, such as adding riparian area fencing and installing off-channel water wells to remove cattle from riparian area. By doing this Mr. Crosswhite hopes to reestablish a properly functioning riparian corridor and eventually recondition Nutrioso Creek so that it meets its turbidity standard and TMDL goals.
- Overgaard Townsite Water Protection Project – The Overgaard Domestic Wastewater Improvement District plans to protect surface and ground water that is presently threatened by an abandoned and failed onsite community wastewater disposal system. Twenty households are presently hooked up to the system, and when functioning, the system consists of a 10,000 gallon septic tank and leach field located on a one-acre parcel just north of the subdivision. Repair of the system is necessary to protect public health, the underlying ground water aquifers, and nearby streams.
- Murray Basin-Saffel Canyon Phase II -- The U.S. Forest Service is to improve two severely degraded areas in tributaries to Nutrioso Creek, by reducing current erosion processes and restore channels to their natural form and function. The Forest Service also plans to realign and upgrade some roads, obliterate some roads and two-track vehicle paths, and revegetate disturbed sites. The project will be implemented directly upstream of Nutrioso Creek, which is currently on the state's 303(d) List of impaired surface waters due to turbidity.
- Rogers Ranch Turbidity Reduction Project – This project focuses on reducing turbidity in Nutrioso Creek by restoring exposed stream banks and increasing vegetation growth using riparian fencing, off-channel water wells, and keeping water caps closed during the growing season.
- Upper Little Colorado River – Big Ditch Water Loss and Water Quality Improvement Project – Water on the Little Colorado River is diverted into the "Big Ditch" approximately six miles upstream of the town of

Eagar. Eagar plans to line the ditch with an impervious liner to cure the leakage now occurring in the ditch. This actions is to improve water quality by enhancing riparian growth and by increasing flows in the Little Colorado River.

Water Augmentation -- In 1999, researchers from the University of Arizona, with funding from the Arizona Rural Watershed Initiative, began water augmentation studies. Studies include looking at possible watershed management practices that might lead to increased runoff, and determining the feasibility of weather modification through precipitation patterns.

East Clear Creek Strategy Watershed Recovery Plan for the Little Colorado Spinedace and Other Riparian Species -- This strategy was developed in coordination with various agencies responsible for managing habitat, activities, and wildlife resources to identify those activities that will assist in the recovery of the Little Colorado spinedace (a species federally listed as "threatened") and its habitat within the East Clear Creek drainage area. The strategy suggested management actions common to the entire watershed to substantially reduce both the direct and indirect impacts of recreation, roads, livestock and elk grazing, and predatory aquatic species on the spinedace. These strategies will also benefit other riparian species. These strategies include:

- Remove or reduce introduced fish and crayfish;
- Survey spinedace locations, identify problems associated with recreation, road locations and use, livestock management, timber harvesting, and sport fish management, and develop solutions to these problems through the National Environmental Protection Act process.
- Provide supplemental stocking of Spinedace in perennial stretches to restore depleted populations;
- Pursue agreements and in-stream flow water rights to maintain stream flow in major tributaries and aqueducts; and ensure that the needs of aquatic species are considered in current and future water rights discussions.
- Manage elk and livestock to prevent degradation or improve meadows and riparian areas (e.g., exclosures, monitor watershed conditions, recommend population densities in line with natural habitat fluctuations due to rainfall).
- Take actions to restore and maintain riparian functioning condition and mimic historic flows (e.g., manage habitat for riparian species, planting and seeding, restrict or eliminate vehicles in meadows and riparian

areas, reduce or eliminate camping in meadows);

- Evaluate roads and close/remove unneeded roads, relocate problem roads, and encourage the use of roads that do not negatively impact areas. Designate areas for off-road vehicles, and direct camping to specific areas.
- Educate and inform the public concerning these strategies.

The plan recommends specific actions for stream reaches and lakes within this drainage area and a prioritized implementation schedule. An annual report will evaluate whether actions are being accomplished and report on the effectiveness monitoring.

Further information concerning this report and strategy implementation can be obtained by contacting the US Fish and Wildlife Service or the Arizona Game and Fish Department.

Ground Water Studies and Mitigation Projects

Fort Valley Study -- ADEQ completed a ground water quality study in the small community of Fort Valley to look at possible impacts of septic systems on perched aquifers in the area. Samples were collected in 1993, 1994, and 1995 during varied climatic conditions -- dry and wet seasons -- to determine whether permanent or temporary ground water quality issues occurred due to septic systems.

From this study, ADEQ made the following conclusions and recommendations:

- The minimal extent of ground water contamination by septage-indicator parameters (e.g., nutrients, bacteria, total dissolved solids, chloride, sulfate) does not warrant recommending replacing currently installed septic systems with alternative wastewater disposal systems. However, caution should be exercised in selecting appropriate locations and types of additional systems and the operation of current systems.
- During periods of heavy precipitation, when ground water levels rise due to recharge, it would be prudent to dispose of wastewater by pumping septic tanks rather than allowing the septic effluent to possibly leach through saturate soil which would fail to provide proper filtration.
- It would be prudent for home owners to subject their septic tanks to a tightness test to determine if their septic systems were operating properly.

- To avoid ground water contamination, only alternative onsite wastewater treatment systems, designed by an engineer, should be used where the soil is rated as "unsuitable for use as a leach field" by the Natural Resources Conservation Service (shallow ground water). These systems must conform to ADEQ's Engineering Bulletin #12 and be approved for use by the county health department.
- Shallow perched aquifers (e.g. less than 15 feet below land surface, should be avoided as domestic water sources. Wells going through these perched aquifers should be properly sealed to exclude the entry of shallow or surface water.

This report was published in 1995. Further information can be obtained from Douglas Towne at (602) 771-4412 or e-mail him at dct@ev.state.az.us.

Black Mesa Study – The Navajo Nation and Hopi Tribe of the Black Mesa area, Arizona depend on ground water to meet most tribal and industrial needs. Increasing use of this aquifer is creating concerns about adverse effects of withdrawals on the water resources of this region. The US Geological Survey (USGS) conducted a study of recharge rates and hydraulic conductivity of the aquifer to provide a conceptual model of ground water flow and to estimate recharge rates and hydraulic conductivity.

Adjusted radiocarbon data indicates that more than 90 percent of the water in the aquifer is older than 10,000 years and was recharged during glacial periods. In some areas, the ground water was more than 35,000 years old. Hydrologic conductivities (movement of water in the soil) is estimated at from 0.05 to 2.1 feet per day, averaging 0.65 feet per day.

Copies of this investigation can be obtained from the USGS office in Tucson, Arizona (USGS Water Resources Investigation Report number 96-4190 -- Lopes and Hoffman, 1997).

Watershed Partnerships

Three watershed partnerships are working on water quantity and water quality concerns in the Little Colorado River-San Juan Watershed.

The Little Colorado River Multiple Objective Management (LCR-MOM) – This group uses a multi-objective management strategy which balances environmental and economic concerns to address all of this watershed's concerns

-- flooding, sedimentation, stream form and function restoration, water conservation, recreation and tourism, irrigation systems and more. LCR-MOM provides an opportunity for citizens, businesses, and communities to establish a voluntary collaborative approach to enhancement of the quality of life within the watershed. It has identified the following major goals along with specific objectives and actions to accomplish each of them:

- Broaden people's knowledge of and involvement in the LCR-MOM planning process;
- Improve information and technology transfer on its resources;
- Sustain economic growth of the natural resources industry;
- Enhance the quality of life;
- Reduce risk and economic impacts from flood and other natural disasters;
- Increase proper function characteristics of the river systems;
- Enhance recreational opportunities;
- Preserve the cultural heritage;
- Maintain and improve water quality for all uses;
- Increase opportunities for conservation and multiple use of water resources;
- Improve watershed and stream function to promote diverse, stable, and productive wildlife and fish habitat; and
- Enhance networking among individuals, agencies, and organizations with an interest in this watershed.

The LCR-MOM holds regularly scheduled workshops and meetings. To obtain further information you can contact a representative at (520) 524-6063, extension 5 or <http://www.littlecolorado.org>.

The Upper Little Colorado River Watershed Partnership – The partnership has identified the following as goals:

- Water quantity conservation -- Conserve surface and ground water by:
 - a. improving irrigation efficiency through replacing open ditches with lined channels and pipes, minimizing irrigation water run-off;
 - b. evaluate the use of low water use crops where possible; and
 - c. evaluate the possibility of water augmentation through watershed management and weather modification, both winter snow and summer rain.

- Conserve ground water resources -- Substitute surface water for ground water, where possible, to help maintain and eventually raise ground water levels. Quantify ground water levels and pumping. continue monitoring pumping, ground water levels, and drawdown.
- Water quality protection and improvement -- Improve surface water quality by:
 - a. reducing stream bank erosion;
 - b. coordinating restoration and enhancement efforts;
 - c. providing alternative wildlife and stock water sources;
 - d. extend sewer infrastructure to outlying areas, eventually eliminating septic tanks and leach fields to improve ground water quality;
 - e. evaluate the use of treated sewage effluent for pasture, golf courses, wildlife habitat, etc;
 - f. evaluate the feasibility of combining the sewage collection and treatment systems of Springerville and Eager; and
 - g. evaluate the feasibility of silt removal from Lyman Lake and sediment storage on Coyote Creek.
- Land and resource conservation -- Encourage the continued implementation of various conservation measures such as:
 - a. Improve grazing management practices such that the watershed will sustain natural vegetation, thus improving habitat and water quality. This includes fencing to improve grazing management and providing off-stream drinking water facilities for wildlife and livestock;
 - b. Install erosion and sediment control structures where needed;
 - c. Develop proper timber management practices including small diameter logging to increase water yield, maintain a continuous supply of wood fiber and reduce erosion, prevent wildfires through "controlled burning" practices.
 - d. Protect and enhance threatened and endangered species habitat; protect and enhance habitat for wildlife and flora; protect and develop wetlands;
 - e. Evaluate and develop recreational opportunities (fishing hunting, access to surface waters, wildlife viewing, and trails for hiking, equestrian, and off-road vehicles).
- Public Outreach -- Hold meeting to make the public aware of activities and future projects. Develop a web site. Support a local education center and develop demonstration areas and outdoor classrooms.

A steering committee is composed of local communities, water user groups, the Hopi Tribe, Apache County, and local citizens with technical support from state

and federal agencies.

The Nutrioso Creek Watershed Partnership -- This work group was formed in 1998 to provide oversight for implementation projects and plans, and may provide additional data in the form of volunteer monitoring of Nutrioso Creek. This partnership is officially represented at the Upper Little Colorado River Watershed Partnership meetings. This work group maintains a website with information about the 319 funded projects on Nutrioso Creek at Jim Crosswhite's E.C. Bar Ranch at: <http://www.ecbarranch.com/>. This website also provides information about grant writing, funding sources, and more that may be useful to other partnerships.

Middle Gila Watershed



MIDDLE GILA WATERSHED CHARACTERISTICS

SIZE	12,249 square miles (11% of the state's land area).					
POPULATION BASE	Approximately 3, 190,700 people live in this watershed (estimated from the 2000 census). This is more than 60% of the state's population.					
LAND OWNERSHIP (Figure 27)	Private land	27%	US Forest Service	10%	Other state and federal	4.5%
	Bureau of Land Management	26%	Tribal Land	6%	Military land	3.5%
LAND USES AND PERMITS (Figure 28)	The Phoenix metropolitan area is located in this watershed. Until 20 years ago, irrigated agriculture was the primary land and water use in the greater Phoenix area; however, this use is being displaced by rapid urbanization. Outside the urbanized area, livestock grazing is the primary land use. Abandoned mines occur across this watershed but are more concentrated in the Prescott Mining Area.					
HYDROLOGY AND GEOLOGY	<p>This watershed is defined by the Gila River drainage area below Coolidge Dam (San Carlos Reservoir) in the east to Painted Rock Dam in the west, excluding the Santa Cruz River and San Pedro River drainages and the Salt River above Granite Reef Dam. The Salt River drainage area below Granite Reef Dam is included in this watershed, instead of in the Salt Watershed, because the water in the Salt River normally is diverted at Granite Reef Dam into a system of canals and becomes hydrologically disconnected from its natural fluvial system. Several distinct surface water sub-basins can be identified in this watershed: Gila River, lower Salt River, Agua Fria River, and Hassayampa River. Surface water diversions and ground water pumping for agricultural and urban uses have left stream beds in the Phoenix area dry. The basin receives limited rainfall; therefore, surface water flow in this basin is primarily attributable to occasional releases from upstream impoundments, effluent from wastewater treatment plants, and agricultural return flows (Brown et al. 1978). The flow in the Gila River above Gillespie Dam, near the downstream extent of this watershed, varies from less than 5 cfs (in 1966) to an estimated 130,000 cfs (in 1993) during a major flood event (USGS 1996).</p> <p>Several ground water basins are included in this watershed, including: Agua Fria, Donnelly Wash, Dripping Springs, Gila Bend, Harquahala Valley, McMullen Valley, Phoenix Active Management Area (AMA), Tiger Wash, and Upper Hassayampa basins, along with portions of the Bill Williams and Lower San Pedro basins, Prescott AMA, and Pinal AMA. The main water-bearing unit is the basin-fill deposits which are found in valleys between the mountains. These deposits of gravel, sand, silt, and clay may yield several hundred gallons per minute to wells. In the mountains, small yields of ground water are obtained from thin alluvial deposits and/or fractured bedrock. (ADWR 1994)</p> <p>The Basin and Range is the primary Hydrologic Province, with only a relatively small portion extending into the Central Highlands Province. The Basin and Range area is characterized by gently-sloping alluvial plains, separated by mountain ranges that trend to the north and northwest.</p>					
UNIQUE WATERS	None					
ECOREGIONS	Primarily Southern Basin and Range, with the northeastern edge in the Arizona-New Mexico Mountains.					
OTHER STATES, NATIONS, OR TRIBES	<p>This watershed receives drainage from the upper Gila River, the San Pedro River, the Santa Cruz River, the Salt River, and the Verde River. Theoretically it discharges to the Colorado Lower Gila; however, after the dam and related diversions were constructed at Painted Rocks water has flowed past Painted Rocks Borrow Pit Lake only during a major flood in 1993.</p> <p>Salt River, Fort McDowell, Gila Bend, and Gila River Indian communities are significant stakeholders within this watershed.</p>					

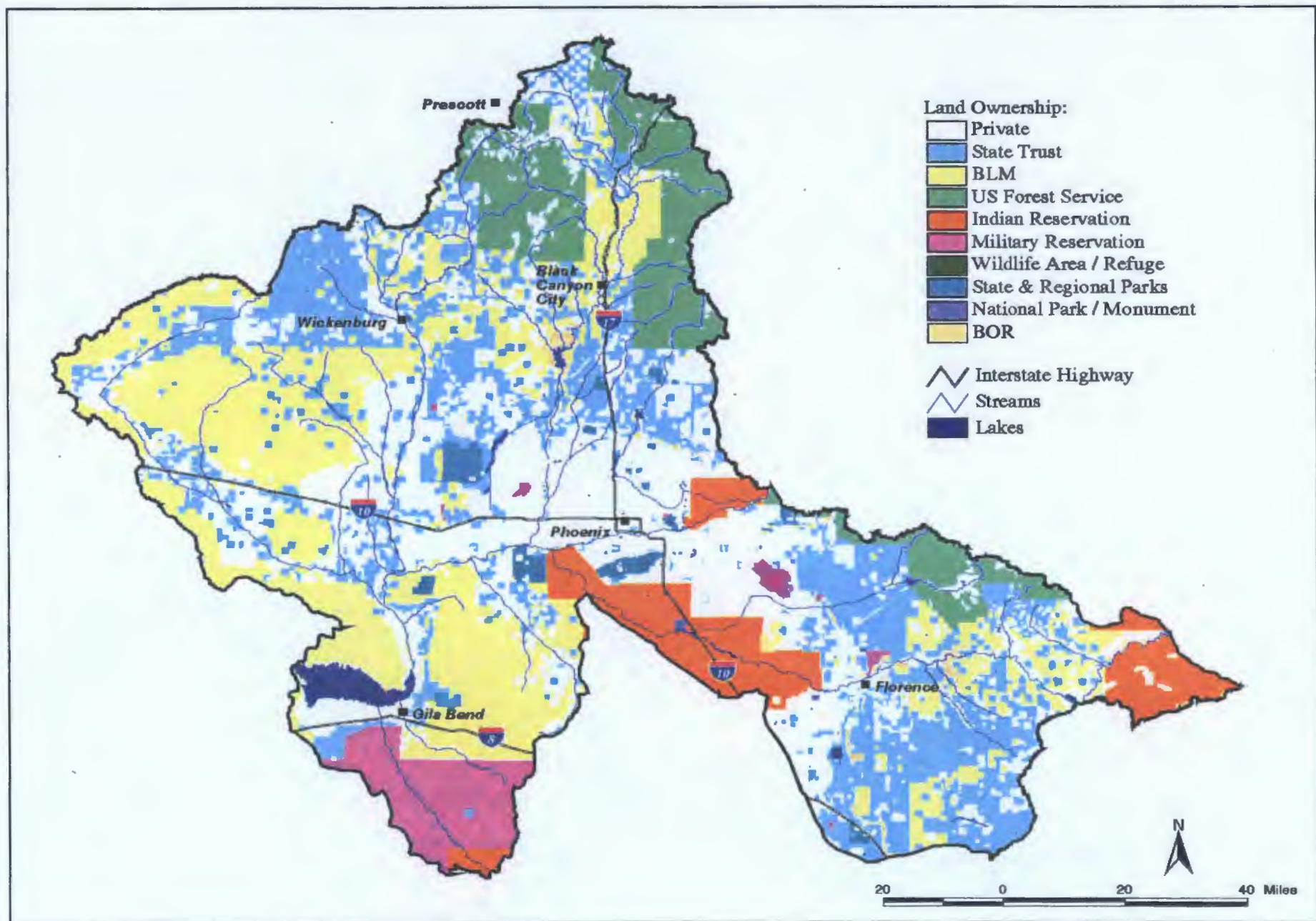


Figure 27. Land Ownership in the Middle Gila Watershed

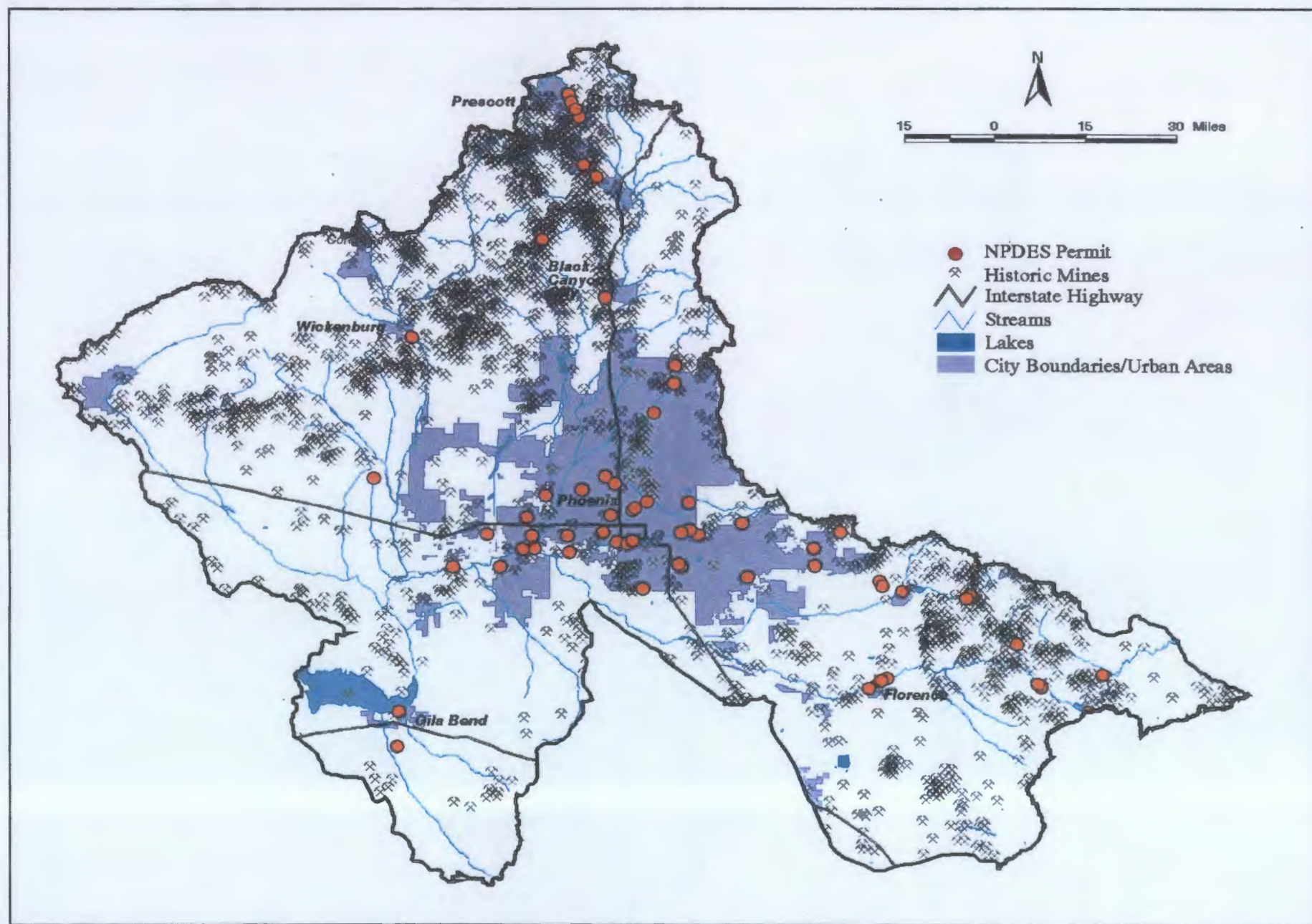


Figure 28. General Land Use and NPDES Permits in the Middle Gila Watershed

Middle Gila Watershed Assessment Discussion

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 432 miles of streams, washes or canals, and 2,469 acres of lakes were assessed. Fewer assessment were completed than in previous assessments because of two factors: 1) changes in assessment criteria requiring more data to base an assessment, and 2) a lack of current credible data as this is a focus watershed for monitoring in 2002. The new data will be included in the next assessment cycle.

Water quality assessment information for the Middle Gila Watershed is summarized in the following tables and illustrated on **Figure 29**.

Table 15. Assessments in the Middle Gila Watershed – 2002

	STREAMS AND CANALS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	52	2	97	5
INCONCLUSIVE	305	26	2,152	3
IMPAIRED	75	6	0	0
NOT ATTAINING	0	0	220	1
TOTAL ASSESSED	432	34	2,469	9

PERENNIAL SURFACE WATERS ASSESSED		STREAMS AND CANALS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	220	21	2,369	8

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial mileage although part of the reach may have ephemeral or intermittent flow.

Inconclusive Assessments – Surface waters with some monitoring data, but insufficient data to determine if a designated use is attaining or impaired, were

added to the new Planning List. By the end of the next watershed monitoring cycle (scheduled in 2007), ADEQ expects to monitor most of these reaches so that all designated uses can be assessed during the following assessment cycle. Other lakes and streams which lack any monitoring data will also be monitored as resources and priorities allow.

ADEQ will be working with US Geological Survey, the Arizona Game and Fish Department, and the Salt River Project, so that their future monitoring will better support Arizona's surface water assessments. For example, all of the canals in the Phoenix metropolitan area were assessed as "inconclusive" because only dissolved metals were analyzed while total metal measurements are also needed to complete assessments.

Major Stressors – When a surface water is listed as impaired, the pollutants or suspected pollutants causing the impairment are identified. The stream reaches and lakes assessed as impaired can be divided into three groups based on pollutants and their probable sources as follows:

- ▶ Historic mining activities have caused impairment of 70 miles of stream reaches along Mineral Creek, Turkey Creek, Queen Creek, and the Hassayampa River due to metals and related low pH;
- ▶ High levels of boron occur in the Gila River below the Phoenix metropolitan area; and
- ▶ High pH values related to algal blooms were occurring in the newly constructed Tempe Town Lake. Newly initiated treatment of algae appears to also be maintaining the pH within surface water quality standards.

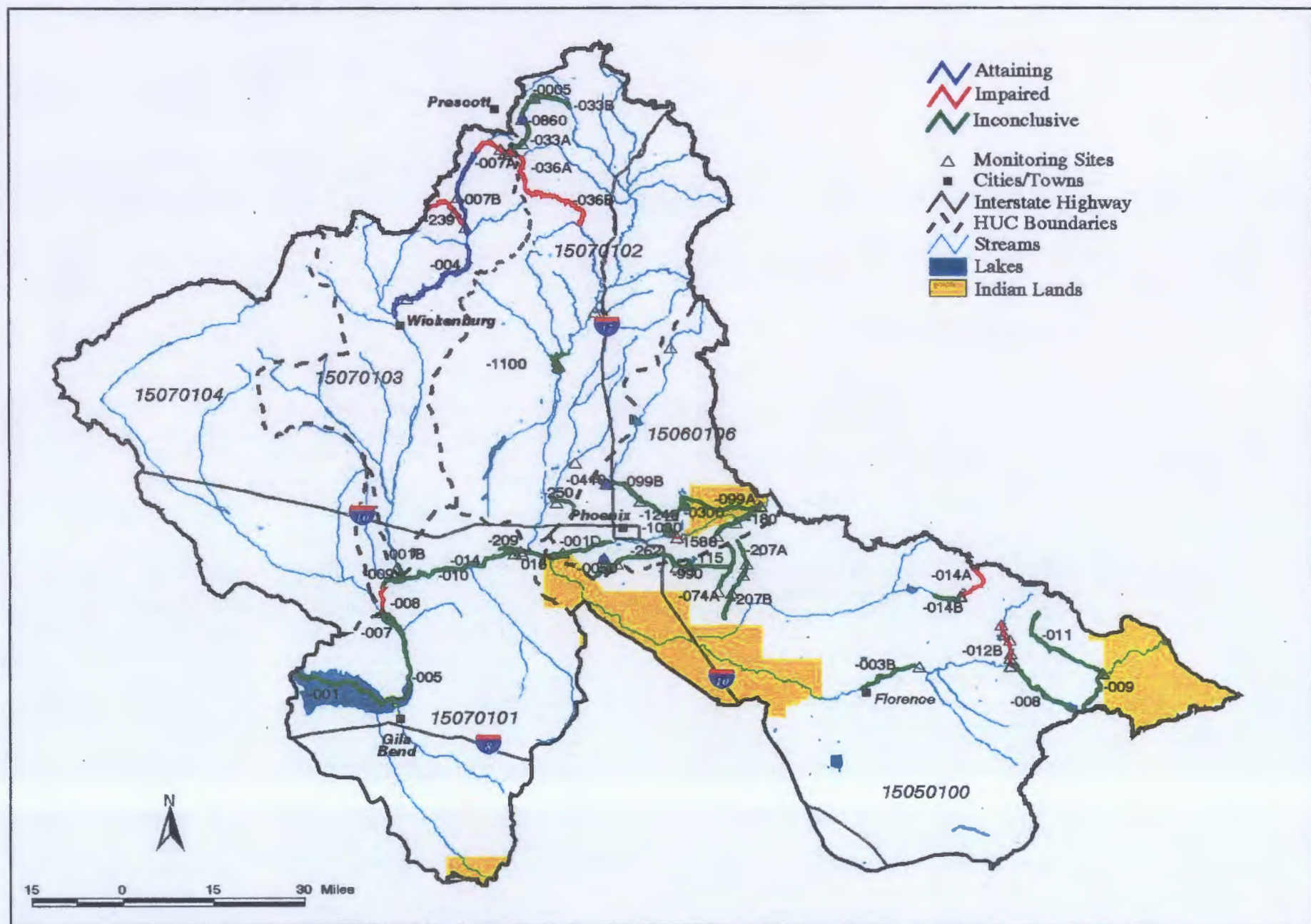


Figure 29. Middle Gila Watershed 2002 Assessments

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Agua Fria River Sycamore Creek-Big Bug AZ15070102-023 A&Ww, FC, FBC, DWS, Agl, AgL	ADEQ Biocriteria Program Above Big Bug Creek MGAFR064.94 100711	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Agua Fria River Little Squaw Creek-Cottonwood AZ15070102-017 A&Ww, FC, FBC, DWS, Agl, AgL	USGS Station #09512800 Near Rock Springs MGAFR043.88 100778	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Agua Fria River Lake Pleasant-Beardsley AZ15070102-008 A&We, PBC, AgL	USGS Station #09523600 Below Waddell Dam MGAFR030.73 100781	1996 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Antelope Creek headwaters-Martinez Creek AZ15070103-010 A&Ww, FC, FBC, Agl, AgL	ADEQ Biocriteria Program Above Road Xing near Stanton MGANT011.29 100713	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Arizona Canal Cholla WTP-15070102 begins AZ15060106B-099B Agl, AgL	SRP Routine Monitoring At 75th Avenue & Greenway MGAZC001.48 SVLT 1-20.0	1996 - 10 suites 1997 - 11 suites 1998 - 11 suites, 10 VOCs 1999 - 11 suites, 5 VOCs 2000 - 11 suites, 8 VOCs, 8 pesticides	OK					Missing core parameters: total metals (only dissolved metals reported).
	Reach Summary Row Agl Inconclusive Agl Inconclusive	1996 - 2000 54 sampling events Missing core parameters	OK				Inconclusive	SRP collected 54 samples in 1996 - 2000. Canal assessed as "Inconclusive" and added to Planning List due to missing core parameters.
Arizona Canal Granite Reef Dam-Cholla WTP AZ15060106B-099A DWS, Agl, AgL	SRP Routine Monitoring At Granite Reef SVCA 1-0.0	1996 - 10 suites, 1 VOCs 1997 - 11 suites, 8 VOCs 1998 - 12 suites, 12 VOCs 1999 - 11 suites, 5 VOCs 2000 - 13 suites, 9 VOCs, 9 pesticides	OK					Missing core parameters: total metals including total arsenic and total barium (only dissolved metals reported).

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	SRP Routine Monitoring At Invergorden (64th Street) MGAZC014.51 SVCA 1-3.9	1996 - 10 suites, 1 VOCs 1997 - 11 suites, 8 VOCs 1998 - 11 suites, 10 VOCs 1999 - 11 suites, 5 VOCs 2000 - 11 suites, 8 VOCs, 8 pesticides	Boron µg/L	630 (DWS) 1000 (Agl)	560 - 1106 (dissolved)	1 of 54		
	SRP Routine Monitoring At Squaw Peak WTP SVCA 1-9.3	1997 - 13 nutrients, 3 VOCs 1998 - 11 nutrients, 3 VOCs 1999 - 11 nutrients, 2 VOCs 2000 - 11 nutrients, 3 VOCs, 3 pesticides	OK					
	SRP Routine Monitoring At Deer Valley WTP SVCA 1-14.5	1996 - 2 nutrients 1997 - 11 nutrients 1998 - 11 nutrients 1999 - 11 nutrients 2000 - 11 nutrients, 3 VOCs, 3 pesticides	OK					
	SRP Routine Monitoring At Cholla WTP SVCA 1-16.6	1996 - 2 nutrients 1997 - 11 nutrients 1998 - 11 nutrients 1999 - 11 nutrients 2000 - 11 nutrients, 3 VOCs, 3 pesticides	OK					
	Reach Summary Row	1996 - 2000 249 sample events Missing core parameters	Boron µg/L	630 (DWS) 1000 (Agl)	560 - 1106 (dissolved)	1 of 54	Inconclusive	
	DWS Inconclusive Agl Inconclusive Agl Inconclusive							SRP collected a total of 249 samples at five sites in 1996-2000. Canal assessed as "Inconclusive" and added to the Planning List due to missing core parameters.
Buckeye Canal 15070101-Hassayampa AZ15070101-209 Agl, AgL	USGS NAWQA Site #09514000 Near Avondale MGBKC000.01	1996 - 4 suites 1997 - 20 suites, VOCs, pesticides 1998 - 10 suites, pesticides	p,p' DDE µg/L	0.001 (Agl, AgL)	0.0087	1 of 1		In 27 other DDE samples, whether or not standards were being met could not be determined because the Laboratory Reporting Limit was higher than the standard. (10 of these included laboratory estimates that exceeded standards.) Missing core parameters: total metals (only dissolved metals reported).
	Reach Summary Row	1996 - 1998 34 sampling events Missing core parameters	p,p' DDE µg/L	0.001 (Agl, AgL)	0.0087	1 of 1	Inconclusive	The USGS collected 34 samples in 1996-1998. Canal assessed as "Inconclusive" and added to the Planning List due to DDE exceedance and missing core parameters.
	Agl Inconclusive AgL Inconclusive							

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Cave Creek headwaters-Cave Creek Dam AZ15060106B-026A A&Ww, FC, FBC, AgL	AGFD Complaint Investigation 4 sites around Silver-X mine MGCVE024.87	1996 - 1 metals, pH	OK					
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Consolidated Canal 15060106B- WTP intake AZ15050100-074A DWS, Agl, AgL	SRP Routine Monitoring At Pecos MGCNC010.03 SVCA 5-14.0	1996 - 12 suites, 3 VOCs 1997 - 11 suites, 9 VOCs 1998 - 11 suites, 10 VOCs 1999 - 12 suites, 6 VOCs 2000 - 12 suites, 9 VOCs, 9 pesticides	OK					Missing core parameters: total metals including total arsenic and total barium (only dissolved metals reported).
	Reach Summary Row DWS Inconclusive Agl Inconclusive AgL Inconclusive	1996 - 2000 58 sampling events Missing core parameters	OK				Inconclusive	SRP collected 58 samples in 1996 - 2000. Canal assessed as "Inconclusive" and added to the Planning List due to missing core parameters.
Crazy Basin Wash headwaters - Poland Wash A&Ww, FBC, FC, AgL	ADEQ TMDL Program French Lily	2001 - 1 metals (no hardness)	OK					
	Reach Summary Row	2000 1 sampling event	OK				Not assessed	Insufficient data to assess.
Devils Canyon headwaters-Mineral Creek AZ15050100-1662 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program South of Highway 60 MGDVC004.36 100534	1997 - 1 suite	OK					
	Reach Summary Row	1997 1 sampling event	OK				Not assessed	Insufficient data to assess.
Dripping Spring Wash headwaters-Gila River AZ15050100-011 A&Ww, FC, FBC, AgL	AGFD Routine Monitoring At Gila River 3 sites combined MGDSW000.21	1997 - 2 suites 1999 - 1 metals	OK					Missing all core parameters except arsenic & copper. The mercury Laboratory Reporting Limit was not low enough to assess Fish Consumption.
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1997 - 1999 3 sampling events Missing core parameters	OK				Inconclusive	AGFD collected three samples in 1997-1999. Reach assessed as "Inconclusive" and added to the Planning List due to missing core parameters and the Laboratory Reporting limit for mercury.
Eastern Canal WTP below Warner Road-terminus AZ15050100-207B Agl, AgL	SRP Routine Monitoring Lateral 14.2 near Pecos MGESC012.13 SVCA 4-14.2	1996 - 9 suites, 1 VOCs 1997 - 9 suites, 7 VOCs 1998 - 10 suites, 9 VOCs 1999 - 9 suites, 4 VOCs 2000 - 9 suites, 8 VOCs, 8 pesticides	OK					Missing core parameters: total metals (only dissolved metals reported).

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row	1996 - 2000	OK				Inconclusive	SRP collected a total of 56 samples in 1996-2000. Canal assessed as "inconclusive" and added to the Planning List due to missing core parameters.
	Agl Inconclusive AgL Inconclusive	56 sampling events Missing core parameters						
Eastern Canal University Ave-WTP Warner Rd. AZ15050100-207A DWS, Agl, AgL	SRP Routine Monitoring At Guadalupe (Gilbert WTP) SVCA 4-9.0	1996 - 2 nutrients 1997 - 11 nutrients, 3 VOCs 1998 - 11 nutrients, 3 VOCs 1999 - 12 nutrients, 2 VOCs 2000 - 12 nutrients, 3 VOCs, 3 pesticides	OK					Missing core parameters: total metals including total arsenic and total barium (only dissolved metals reported).
	SRP Routine Monitoring At Warner Ave, Tempe MGESC009.15 SVCA 4-11.0	1996 - 12 suites, 3 VOCs 1997 - 11 suites, 9 VOCs 1998 - 11 suites, 11 VOCs 1999 - 11 suites, 6 VOCs 2000 - 11 suites, 8 VOCs, 8 pesticides	OK					
	Reach Summary Row	1996 - 2000	OK				Inconclusive	SRP collected 48 samples in 1996 - 2000. Canal assessed as "inconclusive" and added to the Planning List due to missing core parameters.
	DWS Inconclusive Agl Inconclusive AgL Inconclusive	104 samples 60 sampling events Missing core parameters						
French Gulch headwaters-Hassayampa River AZ15070102-239 A&Ww, FBC, FC, Agl, AgL	Arimetco, Inc. Compliance monitoring Above Zonia Gulch (& mine) (MGFRE-AZG)	1996 - 20 suites 1997 - 10 suites 1998 - 9 suites 1999 - 9 suites 2000 - 10 suites	Arsenic (total) µg/L	50 (FBC)	<5 - 74	1 of 59		Missing core parameters: dissolved oxygen, bacteria, boron, and dissolved cadmium, chromium, and lead. 133 beryllium samples were not included because the Laboratory Reporting Limit was too high to assess Fish Consumption.
			Beryllium (total) µg/L	0.21 (FC)	0.03 - 2.0	1 of 5		
			Copper (dissolved) µg/L	varies (65) (A&Ww)	<10 - 300	31 of 56		
			Manganese (total) µg/L	10,000 (Agl)	380 - 52,000	55 of 59		
				19,600 (FBC)		53 of 59		
			Mercury (total) µg/L	0.6 (FC)	0.2 - 1.7	2 of 59		
			Zinc (dissolved) µg/L	varies (379) (A&Ww)	80 - 1100	20 of 56		

TABLE 16. MIDDLE GILA WATERSHED – MONITORING DATA – 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	Arimetco, Inc. Compliance monitoring Below Zonia Gulch (MGFRE-BZG)	1996 - 20 suites 1997 - 10 suites 1998 - 10 suites 1999 - 9 suites 2000 - 10 suites	Arsenic (total) µg/L	50 (FBC)	<5 - 94	1 of 58		Missing core parameters: dissolved oxygen, bacteria, boron, and dissolved cadmium, chromium, and lead.
			Copper (dissolved) µg/L	varies (65) (A&Ww)	<10 - 1200	49 of 55		
			Copper (total) µg/L	500 (AgL)	14 - 1400	29 of 58		
			Manganese (total) µg/L	10,000 (AgI)	190 - 47,700	54 of 58		
				19,600 (FBC)		33 of 48		
			Mercury (total) µg/L	0.6 (FC)	<0.2 - 1.1	1 of 58		
			Zinc (dissolved) µg/L	varies (379) (A&Ww)	40 - 2260	46 of 55		
	Arimetco, Inc. Compliance monitoring Above Placerita Gulch (MGFRE-APG)	1996 - 2 suites 1997 - 2 suites 1998 - 2 suites 1999 - 2 suites 2000 - 3 suites	Manganese (total) µg/L	10,000 (AgI)	<10 - 18,600	1 of 11		Missing core parameters: dissolved oxygen, bacteria, boron, and dissolved cadmium, chromium, and lead.
			Mercury (total) µg/L	0.6 (FC)	<0.2 - 1.7	1 of 11		
	Arimetco, Inc. Compliance monitoring Below Placerita Gulch (MGFRE-BPG)	1996 - 3 suites 1997 - 2 suites 1998 - 2 suites 1999 - 3 suites 2000 - 3 suites	Mercury (total) µg/L	0.6 (FC)	<0.2 - 1.9	1 of 12		Missing core parameters: dissolved oxygen, bacteria, boron, and dissolved cadmium, chromium, and lead.
	Reach Summary Row A&Ww Impaired FC Inconclusive FBC Impaired AgI Impaired AgL Impaired	1996 - 2000 140 samples 60 sampling events Missing core parameters	Arsenic (total) µg/L	50 (FBC)	<5 - 94	2 of 140	Attaining	Arimetco collected a total of 140 samples at 4 sampling sites in 1996-2000. Reach is assessed as impaired due to copper, manganese and zinc. Add to Planning List due to beryllium exceeding standards and missing core parameters.
			Beryllium (total) µg/L	0.21 (FC)	0.03 - 2.0	1 of 7	Inconclusive	
			Copper (dissolved) µg/L	varies (65) (A&Ww)	<10 - 1200	80 of 135	Impaired	
			Copper (total) µg/L	500 (AgL)	14 - 1400	29 of 140	Impaired	
			Manganese (total) µg/L	10,000 (AgI)	190 - 52,000	110 of 140	Impaired	
				19,600 (FBC)		96 of 140	Impaired	
			Mercury (total) µg/L	0.6 (FC)	<0.2 - 1.9	5 of 140	Attaining	
			Zinc (dissolved) µg/L	varies (379) (A&Ww)	40 - 2260	66 of 135	Impaired	

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Gila River Dripping Spring-San Pedro River AZ15050100-009 A&Ww, FC, FBC, AgL	AGFD Special Investigation Below Dripping Spring MGGLR146.49	1997 - 2 suites	OK					Missing core parameters: turbidity, bacteria, boron, and metals. Also, the mercury Laboratory Reporting Limit was too high to assess Fish Consumption.
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1997 2 sampling events Missing core parameters	OK				Inconclusive	AGFD collected two samples in 1997. Reach assessed as "Inconclusive" and added to Planning List due to missing core parameters, lack of sampling events, and the high laboratory reporting limit for mercury.
Gila River, San Pedro-Mineral Creek AZ15050100-008 A&Ww, FC, FBC, AgL, AgI	USGS NAWQA Site #09474000 At Kelvin MGGLR136.90	1996 - 8 suites 1997 - 12 suites 1998 - 6 suites	OK					Missing core parameters: turbidity, bacteria, boron, and insufficient metals.
	AGFD Special Investigation Above Mineral Creek MGGLR136.98	1997 - 2 suites	OK					Missing core parameters: turbidity, bacteria, boron, and insufficient metals. The Laboratory Reporting Limit for mercury was too high to assess Fish Consumption use.
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 1998 28 sampling events Missing core parameters	OK				Inconclusive	USGS collected 26 samples in 1996-1998. AGFD collected 2 samples in 1997. Reach assessed as "Inconclusive" and added to the Planning List due to missing core parameters and high laboratory reporting limit for mercury.
Gila River Ashurst-Hayden-Florence WWTP AZ15050100-003B A&We, PBC, AgL	AGFD Special Investigation At Ashurst-Hayden Dam MGGLR127.23	1997 - 2 suites	Copper (total) µg/L	500 (AgL)	<50 - 710	1 of 2		Missing core parameters: turbidity, bacteria, boron, insufficient metals.
	Reach Summary Row A&We Inconclusive PBC Inconclusive AgL Inconclusive	1997 2 sampling events Missing core parameters	Copper (total) µg/L	500 (AgL)	<50 - 710	1 of 2	Inconclusive	AGFD collected two samples in 1997. Reach assessed as "Inconclusive" and added to the Planning List due to copper exceeding a standard, insufficient sampling events, and missing core parameters.
Gila River Agua Fria River-Waterman Wash AZ15070101-014 A&Wedw, FC, PBC, AgI, AgL	USGS NAWQA Site #09514100 At Estrella Parkway MGGLR093.63	1998 - 1 suite, pesticide	OK					Missing core parameters: turbidity, metals, bacteria, boron
	USGS NAWQA Site #09513990 Above Head of Buckeye Canal MGGLR094.27	1996 - 6 suites, pesticides	OK					Missing core parameters: turbidity, metals, bacteria, boron

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	Reach Summary Row A&Wedw Inconclusive FC Inconclusive PBC Inconclusive Agl Inconclusive AgL Inconclusive	1996 - 1998 7 sampling events Missing core parameters	OK				Inconclusive	USGS collected a total of 7 samples at two sites in 1996-1998. Reach is assessed as "Inconclusive" and added to Planning List due to missing core parameters.
Gila River Centennial Wash-Gillespie Dam AZ15070101-008 A&Wedw, FC, PBC, Agl, AgL	USGS Station #09518000 Above Gillespie Dam MGGLR075.86 100734	1996 - 6 suites 1997 - 6 suites 1998 - 5 suites 1999 - 4 suites 2000 - 4 suites	Boron (total) µg/L	1000 (Agl)	375 - 2235	16 of 21		12 other beryllium samples were not counted because the Laboratory Reporting Limit for beryllium was too high to assess Fish Consumption.
			Beryllium (total) µg/L	0.21 (FC)	<0.1 - 0.6	4 of 11		
			Fecal coliform CFU	800 (A&Wedw)	30 - 2400	3 of 22		
			Mercury (total) µg/L	0.6 (FC)	<0.1 - 1.1	1 of 25		
			Selenium (total) µg/L	20 (Agl)	<0.1 - 33.8	3 of 22		
			Turbidity NTU	50 (A&Wedw)	0.34 - 95.0	3 of 25		
	Reach Summary Row A&Wedw Attaining FC Inconclusive PBC Attaining Agl Impaired AgL Attaining	1996 - 2000 25 sampling events	Boron (total) µg/L	1000 (Agl)	375 - 2235	16 of 21	Impaired	USGS collected 25 samples in 1996-2000. Reach is assessed as impaired due to boron. Also, added reach to Planning List due to beryllium exceeding standards.
			Beryllium (total) µg/L	0.21 (FC)	<0.1 - 0.6	4 of 11	Inconclusive	
			Fecal coliform CFU	800 (A&Wedw)	30 - 2400	3 of 22 (over 4 years)	Attaining	
			Mercury (total) µg/L	0.6 (FC)	<0.1 - 1.1	1 of 25	Attaining	
			Selenium (total) µg/L	20 (Agl)	<0.1 - 33.8	3 of 22	Attaining	
			Turbidity NTU	50 (A&Wedw)	0.34 - 95.0	3 of 25	Attaining	
Grand Canal 15070101-New River AZ15070102-250 Agl, AgL	SRP/USGS Routine Monitoring At 99th Ave, Phoenix SVLT 2-23-0 MGGR000.70	1996 - 10 suites 1997 - 12 suites 1998 - 11 suites 1999 - 11 suites 2000 - 11 suites	OK					Missing core parameters: no total metals (only dissolved metals reported).

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row AgI Inconclusive AgL Inconclusive	1996 - 2000 55 samples Missing core parameters	OK				Inconclusive	SRP collected 55 samples in 1996-2000. Canal assessed as "Inconclusive" due to missing core parameters (total metals).
Hassayampa River headwaters-Copper Creek AZ15070103-007A A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program At Babbie MGHSR110.65 100942	2000 - 1 field, metals	Copper (dissolved) µg/L	varied hardness (A&Ww)	43	1 of 1		
			Zinc (dissolved) µg/L	varied hardness (A&Ww)	380	1 of 1		
	ADEQ TMDL Program Below Senator Mine MGHSR109.68 101036	2000 - 1 metal, nutrient	Zinc (dissolved) µg/L	varied hardness (A&Ww)	770	1 of 1		
	ADEQ TMDL Program At Whispering Pines MGHSR108.17 100941	2000 - 1 field, metal	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.05	1 of 1		Field staff documented that naturally occurring ground water upwelling rather than any anthropogenic activities caused the low dissolved oxygen; therefore, not considered in the final assessment.
			Zinc (dissolved) µg/L	varied hardness (A&Ww)	510	1 of 1		
	Reach Summary Row A&Ww Impaired FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 2000 3 samples 2 sampling events Missing core parameters	Copper (dissolved) µg/L	varied hardness (A&Ww)	13 - 43	1 of 3	Inconclusive	ADEQ collected a total of 3 samples from 3 sites in 2000. Reach is assessed as "Impaired" due to zinc. Add to Planning List due to copper exceedance, missing core parameters, and lack of sampling events.
Hassayampa River Copper Creek-Blind Indian AZ15070103-007B A&Ww, FC, FBC, AgI, AgL	ADEQ TMDL Program At gaging station MGHSR089.37 100940	2000 - 1 field, 1 metal	OK					
	ADEQ Fixed Station Network Near Wagoner, below Milk Creek MGHSR063.02 100464	1996 - 5 suites 1999 - 3 suites 2000 - 4 suites	Arsenic (total) µg/L	50 (FBC)	<10 - 67	1 of 12		
			Beryllium (total) µg/L	0.21 (FC)	16	1 of 1		11 other beryllium samples were not included because the Laboratory Reporting Limit was not low enough to assess Fish Consumption.
			Beryllium (total) µg/L	4 (FBC)	<0.5 - 16	1 of 12		
			Copper (total) µg/L	500 (AgI)	<10 - 1100	1 of 12		

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	2.64 - 6.16	6 of 12		Field staff documented that naturally occurring ground water upwelling rather than any anthropogenic activities caused the low dissolved oxygen; therefore, not considered in the final assessment.
			Fecal coliform CFU/100 ml	4000 (A&Ww, Agl, AgL)	0 - 6400	1 of 8		
			Lead (total) µg/L	100 (Agl)	<5 - 150	1 of 12		
			Turbidity NTU	50 (A&Ww)	0.6 - 1000	1 of 11		
	Reach Summary Row	1996 - 2000	Arsenic (total) µg/L	50 (FBC)	<10 - 67	1 of 12	Attaining	ADEQ collected a total of 13 samples from 2 sites in 1996, 1999- 2000. Reach assessed as "attaining some uses." Add to Planning List due to fecal coliform and beryllium exceeding standards.
	A&Ww Inconclusive	13 samples	Beryllium (total) µg/L	0.21 (FC)	16	1 of 1	Inconclusive	
	FC Attaining		Beryllium (total) µg/L	4 (FBC)	<0.5 - 16	1 of 12	Attaining	
	FBC Attaining		Copper (total) µg/L	500 (Agl)	<10 - 1100	1 of 13	Attaining	
	Agl Inconclusive		Fecal coliform CFU/100 ml	4000 (A&Ww, Agl, AgL)	0 - 6400	1 of 8	Inconclusive	
	AgL Inconclusive		Lead (total) µg/L	100 (Agl)	<5 - 150	1 of 12	Attaining	
			Turbidity NTU	50 (A&Ww)	0.8 - 1000	1 of 12	Attaining	
Hassayampa River Cottonwood Creek-Martinez AZ15070103-004 A&Ww, FC, FBC, Agl, AgL	ADEQ Fixed Station Network At Box Canyon Dam MGHSR049.89 100463	1999 - 3 suites	Arsenic (total) µg/L	50 (FBC)	<10 - 53	1 of 7		Seven other beryllium samples were not included because the Laboratory Reporting Limit for beryllium was too high to assess Fish Consumption.
		2000 - 4 suites	Beryllium (total) µg/L	0.21 (FC)	3.7 - 13	2 of 2		
			Beryllium (total) µg/L	4 (FBC)	<0.5 - 13	1 of 7		
			Copper (total) µg/L	500 (Agl)	<10 - 610	1 of 7		
			Escherichia coli CFU/100 ml	580 (FBC)	2 - 11400	1 of 6		

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive Agl Attaining AgL Inconclusive	1999 - 2000 7 samples	Lead (total) µg/L	100 (AgL)	<5 - 170	1 of 7		
			Turbidity NTU	50 (A&Ww)	0.8 - >1000	2 of 7		
			Arsenic (total) µg/L	50 (FBC)	<10 - 53	1 of 7	Inconclusive	USGS collected 7 samples in 1999-2000. Reach assessed as "attaining some uses." Add to Planning List due to arsenic, beryllium, copper, E. coli, lead, and turbidity exceeding standards.
			Beryllium (total) µg/L	0.21 (FC)	3.7 - 13	2 of 2	Inconclusive	
			Beryllium (total) µg/L	4 (FBC)	<0.5 - 13	1 of 7	Inconclusive	
			Copper (total) µg/L	500 (AgL)	<10 - 610	1 of 7	Inconclusive	
			Escherichia coli CFU/100 ml	500 (FBC)	2 - 11400	1 of 6	Inconclusive	
			Lead (total) µg/L	100 (AgL)	<5 - 170	1 of 7	Inconclusive	
			Turbidity NTU	50 (A&Ww)	0.8 - >1000	2 of 7	Inconclusive	
Hassayampa River Buckeye Canal - Gila River AZ15070103-001B A&Ww, FC, FBC, AgL	USGS NAWQA Site #09517000 Below Buckeye Canal near Arlington MGHSR001.56	1996 - 8 suites, pesticides 1997 - 29 suites, pesticides 1998 - 11 suites, pesticides	DDE µg/L	0.001 (AgL) 0.0006 (FC)	0.0061 - 0.012	10 of 10		In 30 other DDE samples, whether or not standards were being met could not be determined because the Laboratory Reporting Limit was higher than the standard. (In 23 of these, laboratory estimates of the results exceeded standards.) Missing core parameters: no turbidity, bacteria, insufficient metals
			Ammonia mg/L	varies (A&Ww)	0.03 - 11.0	2 of 48		Standard varies dependent on pH and temperature.
			Reach Summary Row					
			A&Ww Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive					
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	1996 - 1998 48 samples Missing core parameters	p,p' DDE µg/L	0.001 (AgL) 0.0006 (FC)	0.0061 - 0.012	10 of 10	Inconclusive (see comment)	USGS collected 48 samples in 1996-1998. Reach assessed as "inconclusive" and added to the Planning List due to DDE exceeding standards and missing core parameters.
			Ammonia mg/L	varies (A&Ww)	0.03 - 11.0	2 of 48	Attaining	
Little Ash Creek headwaters-Ash Creek AZ15070102-039 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program Near Estler Peak MGLAS003.16 100578	1998 - 1 suite	OK					

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess. Not enough sampling events.
Lynx Creek headwaters-Agua Fria River AZ15070102-033 A&Ww, FC, FBC, AgL	AGFD Routine Monitoring MGLNX008.50	1998 - 1 metals only 1 field + nutrients + NH3	Cadmium (total) µg/L	41 (FC) 70 (FBC) 50 (AgL)	104	1 of 1		
			Copper (total) µg/L	500 (AgL)	1580	1 of 1		
	Reach Summary Row	1998	Cadmium (total) µg/L	41 (FC) 70 (FBC) 50 (AgL)	104	1 of 1	Inconclusive	AGFD collected two samples in 1998. Reach assessed as "Inconclusive" and should be added to the Planning List due to cadmium and copper exceeding standards, lack of monitoring events, and missing core parameters.
	A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	2 sampling events Missing core parameters	Copper (total) µg/L	500 (AgL)	1580	1 of 1	Inconclusive	
Mineral Creek Devils Canyon-Gila River AZ15050100-012B A&Ww, FC, FBC, AgL	ASARCO Permit Monitoring Al Indian Gardens (above mine) (Surf 1) MGMIN007.55	1997 - 1 suite 1998 - 12 suites 1999 - 12 suites 2000 - 12 suites	Beryllium (total) µg/L	0.21 (FC)	<0.2 - 1.0	2 of 37		Missing core parameter: bacteria.
			Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	3.5 - 17.5	11 of 32		Field staff documented that naturally occurring ground water upwelling rather than any anthropogenic activities caused the low dissolved oxygen; therefore, not considered in the final assessment.
			Turbidity NTU	50 (A&Ww)	0.5 - 960	3 of 37		Missing core parameter: bacteria.
	ASARCO Permit Monitoring Mineral Creek Diversion Tunnel Inlet MGMIN005.77	1998 - 10 suites 1999 - 12 suites 2000 - 12 suites	Beryllium (total) µg/L	0.21 (FC)	<0.2 - 47.0	23 of 34		Missing core parameter: bacteria.
			Beryllium (total) µg/L	4 (FBC)	<0.2 - 47.0	7 of 34		
			Cadmium (dis.) µg/L	varied hardness (A&Ww)	<0.5 - 520	2 of 34		
			Cadmium (total) µg/L	41 (FC) 50 (AgL) 70 (FBC)	<0.5 - 550	6 of 34 5 of 34 5 of 34		
			Chromium VI µg/L	16 (A&Ww)	<10 - 20	1 of 34		
			Copper (dissolved) µg/L	varied hardness (A&Ww)	<20 - 19000	20 of 34		
			Copper (dissolved) µg/L	5200 (FBC)	<20 - 19000	2 of 34		

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Copper (total) µg/L	500 (AgL)	<20 - 20000	9 of 34		
			Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	2.23 - 18.27	17 of 31		Field staff documented that naturally occurring ground water upwelling rather than any anthropogenic activities caused the low dissolved oxygen; therefore, not considered in the final assessment.
			Fluoride µg/L	8400 (FBC)	200 - 23000	2 of 32		Missing core parameter: bacteria.
			Nickel (total) µg/L	730 (FC)	<50 - 2000	2 of 34		
			pH (low) SU	6.5 - 9.0 (A&W, FBC, AgL)	4.5 - 7.9	10 of 33		
			Turbidity NTU	50 (A&Ww)	0.4 - 560	4 of 34		
			Zinc (dissolved) µg/L	varied hardness (A&Ww))	<40 - 28000	22 of 34		
			Zinc (total) µg/L	22000 (FC) 25000 (AgL)	<40 - 28000	2 of 34 1 of 34		
	ASARCO Permit Monitoring Mineral Creek Diversion Tunnel Outlet (Surf 3) MGMIN004.74	1996 - 10 suites 1997 - 7 suites 1998 - 12 suites 1999 - 12 suites 2000 - 12 suites	Beryllium (total) µg/L	0.21 (FC)	<0.2 - 3.4	16 of 53		Missing core parameter: bacteria.
			Copper (dissolved) µg/L	varied hardness (A&Ww)	<2 - 180	10 of 53		
			Copper (total) µg/L	500 (AgL)	<20 - 2000	4 of 53		
			Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.42 - 17.39	9 of 32		Field staff documented that naturally occurring ground water upwelling rather than any anthropogenic activities caused the low dissolved oxygen; therefore, not considered in the final assessment.
			Turbidity NTU	50 (A&Ww)	0.3 - 535	3 of 53		Missing core parameter: bacteria.
			Sulfide µg/L	100 (A&Ww)	<100 - 400	1 of 17		
			Zinc (dissolved) µg/L	varied hardness (A&Ww)	<40 - 430	2 of 53		

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ASARCO Permit Monitoring RCC Channel Tunnel Outlet (Surf 8) MGMIN002.21	1998 - 8 suites 1999 - 4 suites 2000 - 1 suites	Beryllium (total) µg/L	0.21 (FC)	<0.2 - 3.4	5 of 13		Missing core parameter: bacteria.
			Copper (dissolved) µg/L	varied hardness (A&Ww)	27 - 1400	11 of 13		
			Copper (total) µg/L	500 (AgL)	33 - 1800	5 of 13		
			Turbidity NTU	50 (A&Ww)	1.25 - 508	2 of 13		
			Zinc (dissolved) µg/L	varies (A&Ww)	<40 - 430	1 of 13		
	ASARCO Permit Monitoring Below highway bridge 177 (Surf 10) MGMIN001.35	1996 - 8 suites 1997 - 8 suites 1998 - 8 suites 1999 - 4 suites 2000 - 6 suites	Beryllium (total) µg/L	0.21 (FC)	<0.2 - 1.0	21 of 31		Missing core parameter: bacteria.
			Cadmium (total) µg/L	41 (FC) 50 (AgL) 70 (FBC)	<0.5 - 82	2 of 33 2 of 33 1 of 33		
			Copper (dissolved) µg/L	varied hardness (A&Ww)	<20 - 48000	24 of 32		
			Copper (dissolved) µg/L	5200 (FBC)	<20 - 48000	1 of 32		
			Copper (total) µg/L	500 (AgL)	<20 - 51000	14 of 33		
			Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.49 - 9.6	1 of 17		Field staff documented that naturally occurring ground water upwelling rather than any anthropogenic activities caused the low dissolved oxygen; therefore, not considered in the final assessment.
			pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	4.41 - 8.83	1 of 19		Missing core parameter: bacteria.
			Turbidity NTU	50 (A&Ww)	0.16 - 515	5 of 32		
			Zinc (dissolved) µg/L	varied hardness (A&Ww)	<40 - 3500	11 of 32		
	AGFD Special Investigation State route 177 Bridge	2000 - 1 suites	OK					Missing core parameters.

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENTS

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row	1996 - 2000	Beryllium (total) µg/L	0.21 (FC)	<0.2 - 47.0	67 of 169	Impaired	ASARCO collected a total of 170 samples from five sites in 1996-2000. AGFD collected 1 sample in 2000. Mineral Creek is assessed as "Impaired" due to beryllium, copper, and zinc. At the tunnel inlet site, Mineral Creek is also impaired by low pH.
	A&Ww	171 samples	Beryllium (total) µg/L	4 (FBC)	<0.2 - 47.0	7 of 169	Attaining	
	FC	54 sampling events	Cadmium (dissolved) µg/L	varied hardness (A&Ww)	<0.5 - 520	2 of 169	Attaining	
	FBC	Missing core parameters	Cadmium (total) µg/L	41 (FC) 50 (AgL)	<0.5 - 550	8 of 169	Attaining	
	AgL		Cadmium (total) µg/L	70 (FBC)	<0.5 - 550	6 of 169	Attaining	
			Chromium VI µg/L	16 (A&Ww)	<10 - 20	1 of 137	Attaining	
			Copper (dissolved) µg/L	varied hardness (A&Ww)	<20 - 48000	65 of 170	Impaired	
			Copper (dissolved) µg/L	5200 (FBC)	<20 - 48000	1 of 170	Attaining	
			Copper (total) µg/L	500 (AgL)	<20 - 51000	32 of 170	Impaired	
			Fluoride µg/L	8400 (FBC)	200 - 23000	2 of 158	Attaining	
			Nickel (total) µg/L	730 (FC)	<50 - 2000	2 of 160	Attaining	
			pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	4.41 - 8.83	11 of 154 10 of 33 at tunnel inlet	Impaired (at tunnel inlet)	
			Turbidity NTU	50 (A&Ww)	0.18 - 960	17 of 169	Attaining	
			Zinc (dissolved) µg/L	varied hardness (A&Ww)	<40 - 28000	38 of 170	Impaired	
			Zinc (total) µg/L	22000 (FC)	<40 - 28000	2 of 170	Attaining	
			Zinc (total) µg/L	25000 (AgL)	<40 - 28000	1 of 170	Attaining	

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENTS

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
New River headwaters-Interstate 17 AZ15070102-006A A&Ww, FC, FBC, Agl, AgL	ADEQ Biocriteria Program Above Burnt Hole Canyon MGNWR040.70 100604	1998 - 1 suites	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess. Not enough sampling events.
Queen Creek headwaters-Superior Mine WWTP AZ15050100-014A A&Ww, FC, PBC, DWS, AgL	BHP NPDES Permit monitoring Above mine discharge AMP1	1997 - 2 field, metals 1998 - 3 field, metals	Copper (dissolved) µg/L	varied hardness (A&Ww)	17 - 31	2 of 5		Missing core parameters: dissolved oxygen, turbidity, bacteria, nitrate/nitrite, fluoride, barium, and boron
	Reach Summary Row A&Ww Impaired FC Attaining PBC Inconclusive DWS Inconclusive Agl Attaining	1997-1998 5 sampling events Missing core parameters	Copper (dissolved) µg/L	varied hardness (A&Ww)	17 - 31	2 of 5 (2 within 2 years)	Impaired	BHP collected 5 samples in 1997-1998. Reach assessed as "Impaired" due to dissolved copper. Also added to the Planning List due to missing core parameters.
Queen Creek Superior Mining WWTP-Potts Cyn AZ15050100-014B A&Wedw, PBC	BHP NPDES Permit monitoring Below mine discharge AMP2	1997 - 2 field, metals 1998 - 3 field, metals	OK					Missing core parameters: dissolved oxygen, bacteria, and turbidity.
	Reach Summary Row A&Wedw Inconclusive PBC Inconclusive	1997 - 1998 5 sampling events Missing core parameters	OK				Inconclusive	BHP collected 5 samples in 1997-1998. Reach assessed as "Inconclusive" and added to the Planning List due to missing core parameters.
Salt River 23rd Ave WWTP-Gila River AZ15060106B-001D A&Wedw, FC, PBC, Agl, AgL	USGS NAWQA Site #09512407 91st Avenue WWTP Outfall MGSLR010.78	1996 - 10 suites, 1997 - 12 suites, 5 VOCs 1998 - 2 suites	OK					Missing core parameters: turbidity, bacteria, boron, mercury, insufficient metals except manganese.
	Reach Summary Row A&Wedw Inconclusive FC Inconclusive PBC Inconclusive Agl Inconclusive AgL Inconclusive	1996 - 1998 24 sampling events Missing core parameters	OK				Inconclusive	USGS collected 24 samples in 1996-1998. Reach assessed as "Inconclusive" and added to the Planning List due to missing core parameters.

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
South Canal Granite Reef Dam-Consolidated Canal AZ15060106B-180 DWS, Agl, AgL	SRP Routine Monitoring At Granite Reef MGSOC000.05 SVCA 3-0.0	1996 - 12 suites, 3 VOCs 1997 - 11 suites, 9 VOCs 1998 - 12 suites, 12 VOCs 1999 - 11 suites, 5 VOCs 2000 - 13 suites, 9 VOCs, 9 pesticides	OK					Missing core parameters: total metals
	SRP Routine Monitoring At Val Vista Plant SVCA 3-1.4	1996 - 2 nutrients 1997 - 13 nutrients, 2 inorganics, 3 VOCs 1998 - 11 nutrients, 3 VOCs 1999 - 11 nutrients, 1 VOCs 2000 - 12 nutrients, 3 VOCs, 3 pesticides	OK					
	SRP Routine Monitoring At Division Gates Near Brown MGSOC006.83 SVCA 3-3.3	1996 - 12 suites, 3 VOCs 1997 - 11 suites, 9 VOCs 1998 - 11 suites, 11 VOCs 1999 - 10 suites, 4 VOCs 2000 - 12 suites, 9 VOCs, 9 pesticides	OK					
	Reach Summary Row DWS Inconclusive Agl Inconclusive AgL Inconclusive	1997 - 2000 164 samples 61 sampling events Missing core parameters	OK				Inconclusive	SRP collected 164 samples in 1996-2000. Canal assessed as "Inconclusive" due to missing core parameters.
Sycamore Creek headwaters-Agua Fria River AZ15070102-024 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Near Dugas, above Ranger MGSYD004.90 100704	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess. Not enough sampling events.
Tempe Canal 15050100-terminus AZ15050100-115 DWS, Agl, AgL	SRP Routine Monitoring At South Treatment Plant, Guadalupe MGTPC004.16 SVCA 6-9.1	1996 - 11 suites, 3 VOCs 1997 - 10 suites, 9 VOCs 1998 - 11 suites, 10 VOCs 1999 - 8 suites, 2 VOCs 2000 - 10 suites, 9 VOCs, 9 pesticides	OK					Missing core parameters: total metals
	Reach Summary Row DWS Inconclusive Agl Inconclusive AgL Inconclusive	1996 - 2000 50 samples Missing core parameters	OK				Inconclusive	SRP collected 50 samples in 1996 - 2000. Canal assessed as "Inconclusive" due to missing core parameters.
Turkey Creek headwaters-Poland Wash AZ15070101-036 A&Ww, FC, FBC, Agl, AgL	ADEQ TMDL Program At tailings runoff (in stream) MG	2001 - 2 metals (3 samples each event) (both are after precipitation)	Arsenic (total) µg/L	50 (FBC) 200 (Agl) 1450 (FC) 2000 (Agl)	444 - 24700*	2 of 2 2 of 20 1 of 2 1 of 2		* (average of samples each date)

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Cadmium (dissolved) µg/L	varies (A&Ww)	240 - 931*	2 of 2		* (worst case of samples each date)
			Cadmium (total) µg/L	41 (FC) 50 (AgI/AgL) 70 (FBC)	97 - 485*	2 of 2 2 of 2 2 of 2		* (average of samples each date)
			Copper (dissolved) µg/L	varies (A&Ww)	3888 - 13,600*	2 of 2		* (worst case of samples each date)
			Copper (total) µg/L	500 (AgL) 5000 (AgI)	1618 - 8488*	2 of 2 1 of 2		* (average of samples each date)
			Lead (total) µg/L	100 (AgL)	34 - 625*	1 of 2		* (average of samples each date)
			Zinc (dissolved) µg/L	varies (A&Ww)	29,000 - 158,000*	2 of 2		* (worst case of samples each date)
			Zinc (total) µg/L	10,000 (AgI) 22,000 (FC) 25,000 (AgL) 42,000 (FBC)	12,667 - 99513*	2 of 2 1 of 2 1 of 2 1 of 2		* (average of samples each date)
	ADEQ TMDL Program At bridge just above tailings MG	2001 - 4 metals (two times during or after precipitation)	OK					
	ADEQ TMDL Program Below bridge MG	2001 - 3 metals (1 during precipitation)	Arsenic (total) µg/L	50 (FBC) 200 (AgL) 1450 (FC) 2000 (AgI)	<5 - 220	1 of 3 1 of 3 0 of 3 0 of 3		* Exceeded during the 1 rain event
			Copper (dissolved) µg/L	varies (A&Ww)	<15 - 41	1 of 3		* Exceeded during the 1 rain event
			Zinc (dissolved) µg/L	varies (A&Ww)	<20 - 430	1 of 3		* Exceeded during the 1 rain event
	ADEQ TMDL Program At Forest Road 261	2000 - 1 metals (no hardness) (no precipitation)	OK					
	ADEQ TMDL Program At Forest Road 706	2000 - 1 metals (no hardness) (no precipitation)	OK					
	ADEQ TMDL Program At Goodwin	2000 - 1 metals (no hardness) 2001 - 3 metals (no precipitation)	OK					

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ TMDL Program At corral	2000 - 1 metal s (no hardness) (no precipitation)	OK					
	ADEQ TMDL Program At Forest Road 93	2000 - 1 metals (no hardness) 2001 - 1 metals (no precipitation)	OK					
	ADEQ TMDL Program Old biocriteria site	2001 1 metals (no precipitation)	OK					
	Reach Summary Row (Critical condition - precipitation) A&Ww Impaired FBC Inconclusive FC Inconclusive AgI Inconclusive AgL Inconclusive	2000 - 2001 9 samples 5 sampling events Missing Core Parameters	Arsenic (total) µg/L	50 (FBC)	<5 - 24700	3 of 5	Inconclusive	ADEQ collected 9 samples in 2000- 2001. Using data collected during runoff events, the reach is assessed as "Impaired" due to cadmium, copper and zinc during precipitation events. Also, add reach to Planning List due to arsenic and lead exceeding standards.
				200 (AgL)		3 of 5	Inconclusive	
				1450 (FC)		1 of 5	Inconclusive	
				2000 (AgI)		1 of 5	Inconclusive	
			Cadmium (dissolved) µg/L	varies (A&Ww)	240 - 931	2 of 5 (within 3 years)	Impaired	Newer TMDL monitoring data was used because this newer data shows that the reach is impaired and should remain on the 303(d) List.
			Cadmium (total) µg/L	41 (FC)	97 - 485	2 of 5	Inconclusive	
				50 (AgI/AgL)		2 of 5	Inconclusive	
				70 (FBC)		2 of 5	Inconclusive	
			Copper (dissolved) µg/L	varies (A&Ww)	3888 - 13,800	3 of 5 (within 3 years)	Impaired	
			Copper (total) µg/L	500 (AgL)	1618 - 8488	2 of 5	Inconclusive	
				5000 (AgI)		1 of 5	Inconclusive	
			Lead (total) µg/L	100 (AgL)	34 - 625	1 of 5	Inconclusive	
			Zinc (dissolved) µg/L	varies (A&Ww)	29,000 - 158,000	3 of 5 (within 3 years)	Impaired	
			Zinc (total) µg/L	10,000 (AgI)	12,667 - 99513	2 of 2	Inconclusive	
				22,000 (FC)		1 of 2	Inconclusive	
				25,000 (AgL)		1 of 2	Inconclusive	
				42,000 (FBC)		1 of 2	Inconclusive	

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row (Not during critical conditions - precipitation) A&Ww Inconclusive FBC Inconclusive FC Inconclusive AgI Inconclusive AgL Inconclusive	12 samples 12 sampling events Missing core Parameters	OK				Inconclusive	ADEQ collected 12 samples during 2000-2001 at 7 sites. These samples were collected in the absence of a rain event. Reach assessed as "Inconclusive" due to lack of core parameters and added to the Planning List.
Unnamed tributary to Turkey Creek AZ15070101- A&Ww, FBC, FC, AgI, AgL	ADEQ TMDL Program At mouth (near mine tailings)	2001 - 1 metals (during precipitation)	OK					
	Reach Summary Row (during precipitation)	1 sampling event 2001	OK				Not assessed	Insufficient monitoring events and core parameters to assess.
Western Canal Tempe Canal-15050100 AZ15060106B-262 AgI, AgL	SRP Routine Monitoring At Lateral 12.8 Near 19th Ave, Phoenix MGWSC012.39 SVCA 7-12.8	1996 - 12 suites, 3 VOCs 1997 - 12 suites, 9 VOCs 1998 - 11 suites, 10 VOCs 1999 - 11 suites, 5 VOCs 2000 - 11 suites, 9 VOCs, 9 pesticides	OK					Missing core parameters: total metals
	Reach Summary Row AgI Inconclusive AgL Inconclusive	1996 - 2000 57 samples Missing core parameters	OK				Inconclusive	SRP collected 57 samples in 1996 - 2000. Canal assessed as "Inconclusive" and added to the Planning List due to missing core parameters (total metals).
Western Canal 15050100-terminus AZ15050100-990 DWS, AgI, AgL	SRP Routine Monitoring At Kyrene Intake MGWSC006.00 SVCA 7-22E	1996 - 3 nutrients, inorganics 1997 - 8 metals 1998 - 11 metals 1999 - 4 metals 2000 - 9 suites, 9 VOCs, 9 pesticides	Boron µg/L	630 (DWS) 1000 (AgI)	41 - 1140	1 of 12		Missing core parameters: no total metals
	Reach Summary Row DWS Inconclusive AgI Inconclusive AgL Inconclusive	1996 - 2000 35 samples Missing core parameters	Boron µg/L	630 (DWS) 1000 (AgI)	41 - 1140	1 of 12	Inconclusive	SRP collected 35 samples in 1996 - 2000. Canal assessed as "Inconclusive" and added to the Planning List due to missing core parameters (total metals).

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
LAKES MONITORING DATA								
Alvord Park Lake AZL15060106B-0050 A&Ww, FC, PBC	AGFD Urban Lakes Study MGALV-ABC 101053	1998 - 3 suites 1999 - 1 field	Beryllium µg/L	0.21 (FC)	2.5	1 of 1		Three beryllium samples were not counted because the Laboratory Reporting Limit was too high to assess Fish Consumption. Missing core parameter: bacteria.
	AGFD Routine Monitoring up to 6 sites MGALV	1999 - 1 field, ammonia, nutrient samples 2000 - 2 field, ammonia, nutrient samples	OK					Missing core parameters: turbidity and bacteria.
	ADEQ Urban Lakes Study MGALV-A 101040	1998 - 10 field 1999 - 2 field	pH (high) SU	6.5 - 9.0 (A&Ww, PBC)	7.78 - 9.24	1 of 12		Alvord Lake exhibited high dissolved oxygen and high pH readings caused by an algal bloom during the sampling event in June 29, 1998.
	ADEQ Urban Lakes Study MGALV-B 101041	1998 - 10 field 1999 - 2 field	pH (high) SU	6.5 - 9.0 (A&Ww, PBC)	8.39 - 9.26	1 of 12		
	ADEQ Urban Lakes Study MGALV-C 101042	1998 - 10 field 1999 - 2 field	pH (high) SU	6.5-9.0 (A&Ww, PBC)	7.9 - 9.23	1 of 12		
	Reach Summary Row	1998 - 2000	Beryllium µg/L	0.21 (FC)	2.5	1 of 1	Inconclusive	ADEQ and AGFD collected a total of 19 sample events at ten sites in 1998-2000. Sample results collected during the same sampling event were combined in this summary row. Lake assessed as "attaining some uses." Add to Planning List due to beryllium exceeding some uses and missing core parameters.
	A&Ww Inconclusive FC Attaining PBC Inconclusive	43 samples 19 sampling events Missing bacteria samples	pH (high) SU	6.5 - 9.0 (A&Ww, PBC)	7.78 - 9.26	1 of 19	Attaining	
Chaparral Lake AZL15060106B-0300 A&Ww, FC, PBC, Agl	AGFD Routine Monitoring MGCHA	1997 - 1 field	OK					Missing core parameters: bacteria. (No mining activities in the watershed so metals are not required.)
	ADEQ & AGFD Urban Lakes MGCHA-A 101045	1998 - 10 field 1999 - 2 field	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.6 - 13.98	2 of 12		
			pH (high) SU	6.5 - 9.0 (A&Ww, PBC, Agl)	7.86 - 9.36	3 of 12		
	ADEQ & AGFD Urban Lakes MGCHA-B 101046	1998 - 10 field 1999 - 2 field	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.18 - 13.82	2 of 12		
			pH (high) SU	6.5 - 9.0 (A&Ww, PBC, Agl)	8.01 - 9.38	2 of 12		
	ADEQ & AGFD Urban Lakes MGCHA-AB 101056	1998 - 3 metals, ammonia, inorganics 1999 - 1 field	OK					

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	Reach Summary Row	1997 - 1999	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.6 - 13.98	2 of 12	Attaining	ADEQ and AGFD collected a total of 16 sample events at four sites in 1997-1999. Lake assessed as "attaining some uses" and was added to the Planning List due to pH not meeting standards and missing core parameters.
	A&Ww Inconclusive FC Attaining PBC Inconclusive Agl Inconclusive	29 samples 16 sampling events Missing bacteria samples	pH (high) SU	6.5 - 9.0 (A&Ww, PBC, Agl)	7.86 - 9.38	3 of 12	Inconclusive	
Cortez Park Lake AZL15060106B-0410 A&Ww, FC, PBC, Agl	ADEQ & AGFD Urban Lakes MGCOR-A 101043	1998 - 10 field 1999 - 2 field	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.02 - 12.78	1 of 12		Data collected at these sites during the same sampling events were combined for the assessment as they are not spatially independent. Missing core parameters: bacteria.
			pH (high) SU	6.5 - 9.0 (A&Ww, PBC, Agl)	8.09 - 9.96	5 of 12		
	ADEQ & AGFD Urban Lakes MGCOR-B 101044	1998 - 10 field 1999 - 2 field	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	3.9 - 11.26	1 of 12		
			pH (high) SU	6.5 - 9.0 (A&Ww, PBC, Agl)	8.01 - 9.55	4 of 12		
	ADEQ & AGFD Urban Lakes MGCOR-AB 101055	1996 - 3 suites 1999 - 1 field	OK					
	Reach Summary Row	1998 - 1999	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	3.9 - 12.78	1 of 12	Attaining	ADEQ & AGFD collected a total of 12 event samples at three sites in 1998-1999. Cortez Park Lake is assessed as "attaining some uses." Add to Planning List due to pH exceeding standards and missing bacteria samples.
	A&Ww Inconclusive FC Attaining PBC Inconclusive Agl Inconclusive	28 samples 12 sampling events Missing bacteria samples	pH (high) SU	6.5 - 9.0 (A&Ww, PBC, Agl)	8.01 - 9.96	5 of 12	Inconclusive	
Eldorado Park Lake AZL15060106B-0490 A&Ww, FC, PBC	AGFD Routine Monitoring MGELP	1997 - 1 field, ammonia, nutrient	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.8	1 of 1		
	Reach Summary Row	1997 1 sampling event	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.8	1 of 1	Not assessed	Insufficient data to assess all designated uses. Add to Planning List due to low dissolved oxygen.
Encanto Park Lake AZL15060106B-0510 A&Ww, FC, PBC, Agl	AGFD Routine Monitoring MGENC	1997 - 1 suite	OK					
	Reach Summary Row	1997 1 sampling event	OK				Not assessed	Insufficient data to assess.
Fain Lake (in Lynx Creek) AZL15070101-0005 A&Ww, FC, PBC, Agl	AGFD Routine Monitoring 3 sites combined MGFAI	1997 - 1 suite 1998 - 3 suites	OK					Missing core parameters: turbidity, bacteria, some metals. The Laboratory Reporting Limit for mercury was not low enough to assess Fish Consumption.
	Reach Summary Row	1997 - 1998	OK				Inconclusive	AGFD collected 4 samples in 1997-1998. The lake is assessed as "Inconclusive." Add to Planning List due to missing core parameters and the high Laboratory Reporting Limit for mercury.
	A&Ww Inconclusive FC Inconclusive PBC Inconclusive Agl Inconclusive	4 event samples						

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
Lake Pleasant AZL15070102-1100 A&Ww, FC, FBC, Agl, AgL	AGFD Routine Monitoring 4 sites combined MGPLE	1996 - 1 suites 1997 - 2 suites 1998 - 1 suites, 1 field 2000 - 2 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.61 - 9.3	2 of 20		Missing core parameters: dissolved metals, turbidity, bacteria, boron, beryllium, and lead. The Laboratory Reporting Limit for mercury is too high to assess Fish Consumption.
	ADEQ Lakes Program MGPLE-A 100067	2000 - 2 suites, VOCs	OK					Missing core parameters: bacteria. (same event as other ADEQ sites)
	ADEQ Lakes Program MGPLE-B 100068	2000 - 2 suites, VOCs	OK					Missing core parameters: bacteria. (same event as other ADEQ sites)
	ADEQ Lakes Program MGPLE-MAR 101000	2000 - 3 VOCs, pH	OK					Only core parameter was pH.
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	1996 - 2000 13 samples 9 sampling events Missing core parameters	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.61 - 9.3	2 of 23	Attaining	ADEQ & AGFD collected a total of 30 samples at 6 sites. Lake assessed as "inconclusive" core parameters and sampling events.
Lynx Lake AZL15070102-0860 A&Wc, FC, FBC, DWS, Agl, AgL	AGFD Routine Monitoring 5 sites combined MGLYN	1997 - 2 suites 1998 - 3 suites, 4 field 2000 - 2 suites	OK					Missing core parameters: turbidity, dissolved metals, bacteria, arsenic, beryllium, fluoride, barium, and boron. Laboratory Reporting Limit for mercury is too high to assess Fish Consumption.
	Reach Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive Agl Inconclusive AgL Attaining	1997 - 2000 11 sampling events Missing core parameters	OK				Attaining	AGFD collected 11 samples in 1997- 2000. Lake is assessed as "attaining some uses." Add to Planning List due to missing core parameters and the high Laboratory Reporting Limit for mercury.
Papago Park Ponds AZL15060106B-1030 A&Ww, FC, PBC	ADEQ & AGFD Urban Lakes MGPA-P-A 101047	1998 - 10 pH and DO 1999 - 2 pH and DO	OK					This site is combined with MGPA-P-B & MGPA-P-AB because they are not spatially independent.
	ADEQ & AGFD Urban Lakes MGPA-P-B 101048	1998 - 10 pH and DO 1999 - 2 pH and DO	OK					This site is combined with MGPA-P-A & MGPA-P-AB because they are not spatially independent.
	ADEQ & AGFD Urban Lakes MGPA-P-AB 101057	1998 - 3 suites 1999 - 1 ammonia, nutrients	OK					Missing core parameters: bacteria
	Reach Summary Row A&Ww Attaining FC Attaining PBC Inconclusive	1997 - 2000 16 sampling events Missing bacteria samples	OK				Attaining	ADEQ & AGFD collected 12 samples at 1 site. Lake assessed as "attaining some uses." Add to Planning List due to missing bacteria samples.

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
Tempe Town Lake AZL15060106B-158B (Standards have not yet been adopted for the lake; therefore, the lake is assessed under the Salt River designated uses) A&We, PBC	City of Tempe Sampling Aquatic Consulting Upstream Dam site MGTTL-USD	Before treatment 1999 - 1 suite, 14 field & bact 2000 - 21 suites + 31 field 2001 - 21 suites + 31 field 2002 - 16 field	pH (high) SU	6.5 - 9.0 (A&We, PBC)	7.5 - 9.7	26 of 126		
		After treatment 2002 - 13 field	OK					
	City of Tempe Sampling Aquatic Consulting South Shore Line site MGTTL-SSL	Before treatment 1999 - 1 suite, 16 field & bact 2000 - 21 suites + 31 field 2001 - 21 suites + 31 field 2002 - 16 field	pH (high) SU	6.5 - 9.0 (A&We, PBC)	7.7 - 9.7	32 of 125		
		After treatment 2002 - 6 field	OK					
	City of Tempe Sampling Aquatic Consulting Mid Lake site MGTTL-ML	Before treatment 1999 - 1 suite, 15 field & bact 2000 - 21 suites + 31 field 2001 - 21 suites + 31 field 2002 - 16 field	pH	6.5 - 9.0 (A&We, PBC)	7.9 - 9.7	35 of 125		
		After treatment 2002 - 13 field	OK					
	City of Tempe Sampling Aquatic Consulting Mid-depth Downstream site MGTTL-MDD	Before treatment 1999 - 3 suites, 13 field 2000 - 21 suites + 31 field 2001 - 21 suites + 31 field 2002 - 16 field	pH	6.5 - 9.0 (A&We, PBC)	7.8 - 9.7	31 of 124		
		After treatment 2002 - 6 field						
	City of Tempe Sampling Aquatic Consulting Downstream Dam site MGTTL-DSD	Before treatment 1999 - 1 suite, 16 field & bact 2000 - 21 suites + 31 field 2001 - 21 suites + 31 field 2002 - 16 field	pH	6.5 - 9.0 (A&We, PBC)	7.7 - 9.7	35 of 124		
		After treatment 2002 - 13 field						

TABLE 16. MIDDLE GILA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENTS

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	Reach Summary Row A&We Not attaining PBC Not attaining	1999 - 2002 670 samples 249 sampling events	pH (high) SU	6.5 - 8.0 (A&We, PBC)	7.5 - 8.7	169 of 623	Not attaining	City of Tempe collected a total of 670 samples at 5 sites after filling this new lake in 1999 to present. The city is currently applying an algaecide and dye to control algal blooms. This treatment also appears to be effective in keeping the pH values within standards. The lake was assessed as "not attaining" and placed on the Planning List because of: 1. Tempe's commitment to maintain this treatment and lake water quality, 2. The treatment has been successful to date (after 2 months), 3. Tempe continues to monitor weekly and is providing documentation of its technical-based treatment program, and 4. More monitoring is needed to determine the effectiveness of the new treatment.

Information for interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from combining the following: AZ (for streams) or AZL (for lakes) + a US Geological Survey Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses," "Agency," and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year," is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
 - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among the many monitoring entities that provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
 - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
 - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."
 - Although many parameters may be analyzed, only those exceeding a standard are shown. Other parameters were collected.
 - "OK" indicates that no standards were exceeded.
 - The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
 - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
 - A mean, geometric mean, or median will be shown along with the range of results if applicable to the standard or assessment criteria.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or "Inconclusive." See assessment criteria in Chapter III of Volume I.

Ground Water Assessments in the Middle Gila

Major Ground Water Stressors -- Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 17** and illustrated in **Figure 30, 31, and 32**. As **Table 17** indicates, wells are sampled for different constituents.

More than 350 wells were monitored. Of these, 321 wells were monitored in conjunction with Superfund cleanup sites with volatile and semi-volatile organic chemical contamination. **Figure 30** illustrates wells involved in these contamination areas; however, some sites are small, and therefore, difficult to illustrate on this scale map. The types of pollutants and remediation strategies for these sites is included in the following section .

Fluoride contamination seems to be occurring only in the western half of the watershed, while nitrate contamination is widespread across the watershed, and metal contamination is isolated in pockets. It is interesting to note that although significant irrigated crop production has occurred in this watershed, no pesticides were even detected in the 227 wells monitored.

TDS Concentrations -- Water quality can be characterized based on concentration of Total Dissolved Solids (TDS). High levels of salinity limits the practical uses of ground water in some areas of this watershed as TDS over 500 mg/L has an off-flavor, and TDS over 1000 mg/L will limit its use for some crops. Of the 94 wells monitored, 70% were over 500 mg/L and 11% were over the 1000 mg/L. As illustrated in **Figure 31**, elevated TDS occur in wells primarily located next to the Salt and Gila River, with exceptionally high levels of salinity west of Phoenix. (The Salt River was named for its natural salinity.)

No TDS water quality standards apply in this watershed, and the elevated levels of TDS do not present a human-health concern for drinking waters. The TDS concentration is only used to generally characterize water quality.

Nitrate Concentrations -- Water quality can also be characterized by looking at the concentration of nitrates in ground water. Naturally occurring nitrate concentrations in ground water are generally below 3 mg/L. Concentrations above 5 mg/L indicate potential anthropogenic sources of nitrate. Of the 192 wells monitored for nitrate, 57% exceeded this 5 mg/L concentration. As illustrated in **Figure 32**, these wells are scattered across the watershed. These areas may be related to historic irrigated agriculture or septic systems.

When nitrate concentrations exceed 10 mg/L, Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health, as water with nitrate greater than 10 mg/L may present a health problem for babies and should not be consumed by nursing mothers. Forty-eight of the 192 wells monitored (25%) exceeded 10 mg/L. As many of these wells are irrigation wells (not used for drinking water), nitrates over 10mg/L may not represent a human-health concern. However, efforts should be made to minimize further contamination of ground water by nitrate.

Table 17. Middle Gila Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	2		0	0%
	Fluoride	33		2	6%
	Metals/Metalloids	33		2	6%
	Nitrate	33		5	15%
	VOCs + SVOCs*	2	0	0	0%
	Pesticides	2	0	0	0
TARGETED MONITORING WELLS	Radiochemicals	14		1	7%
	Fluoride	104		16	15%
	Metals/metalloids	260		15	6%
	Nitrate	159		43	27%
	VOCs + SVOCs*	319	200	139	44%
	Pesticides	226	0	0	0%

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
94	28	27	19	10

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
192	109	35	48

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.

*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

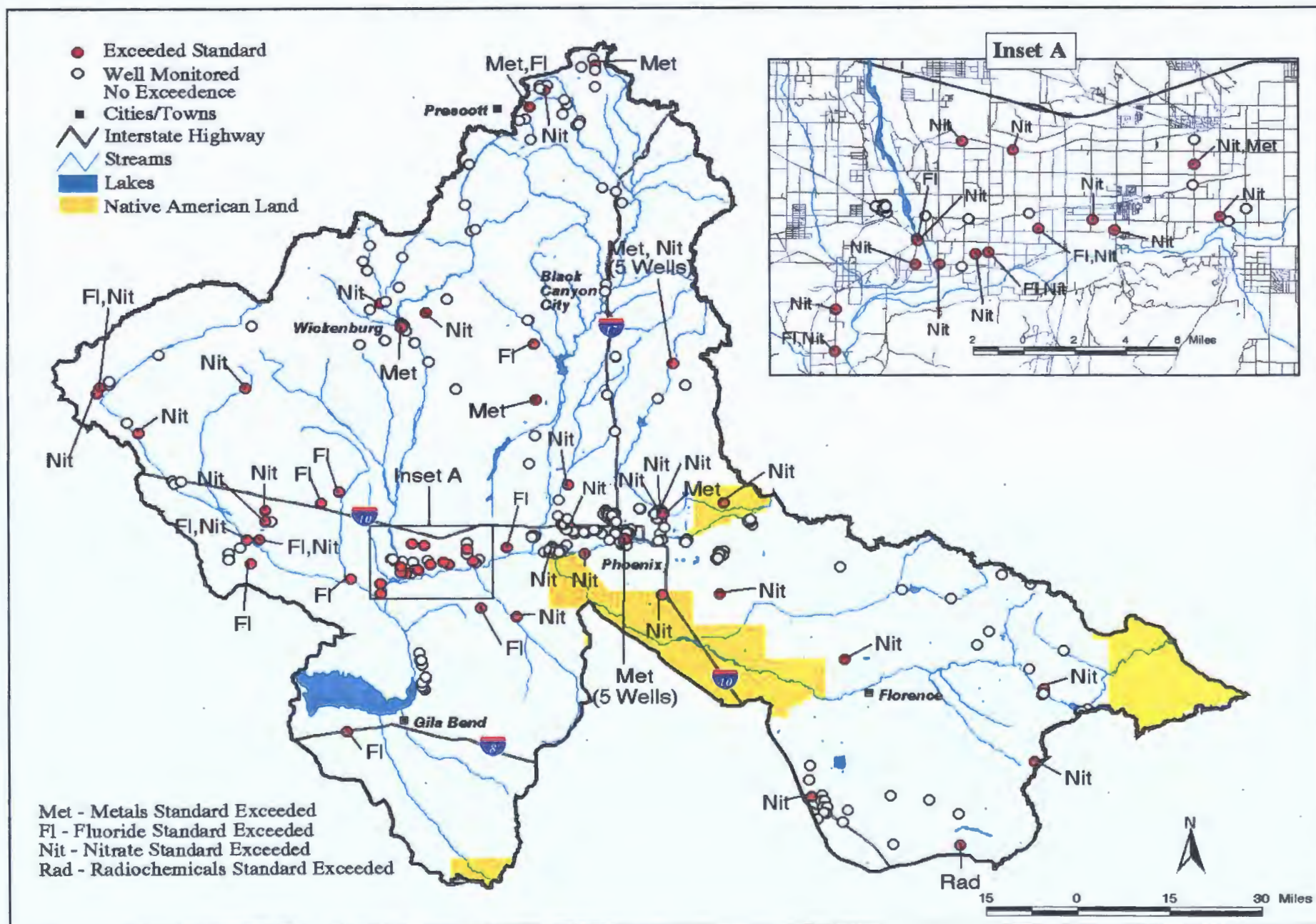


Figure 30a. Ground Water Monitoring in the Middle Gila Watershed – 1995-2000

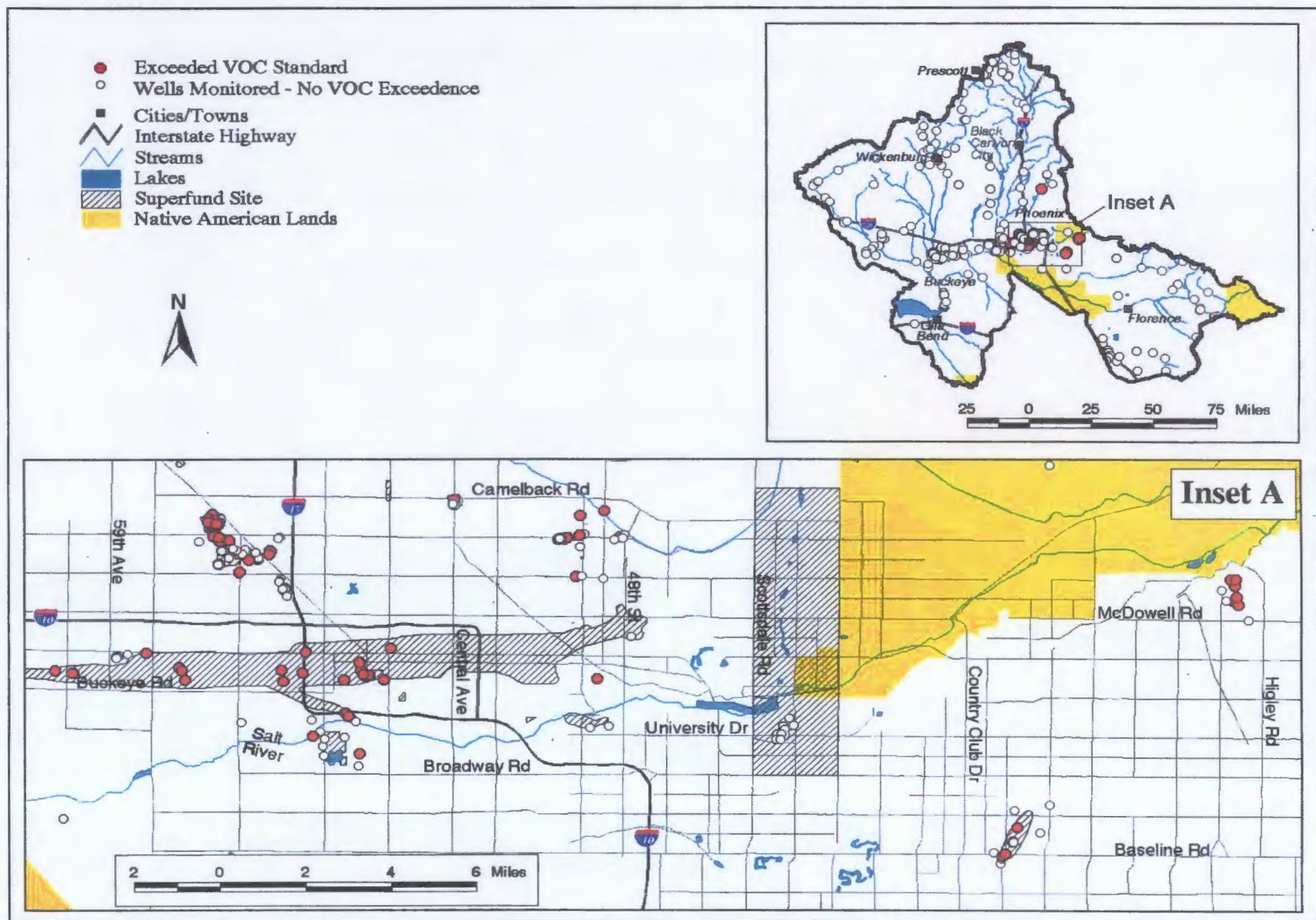


Figure 30b. Volatile and Semi-volatile Organic Compound Well Contamination in the Middle Gila Watershed

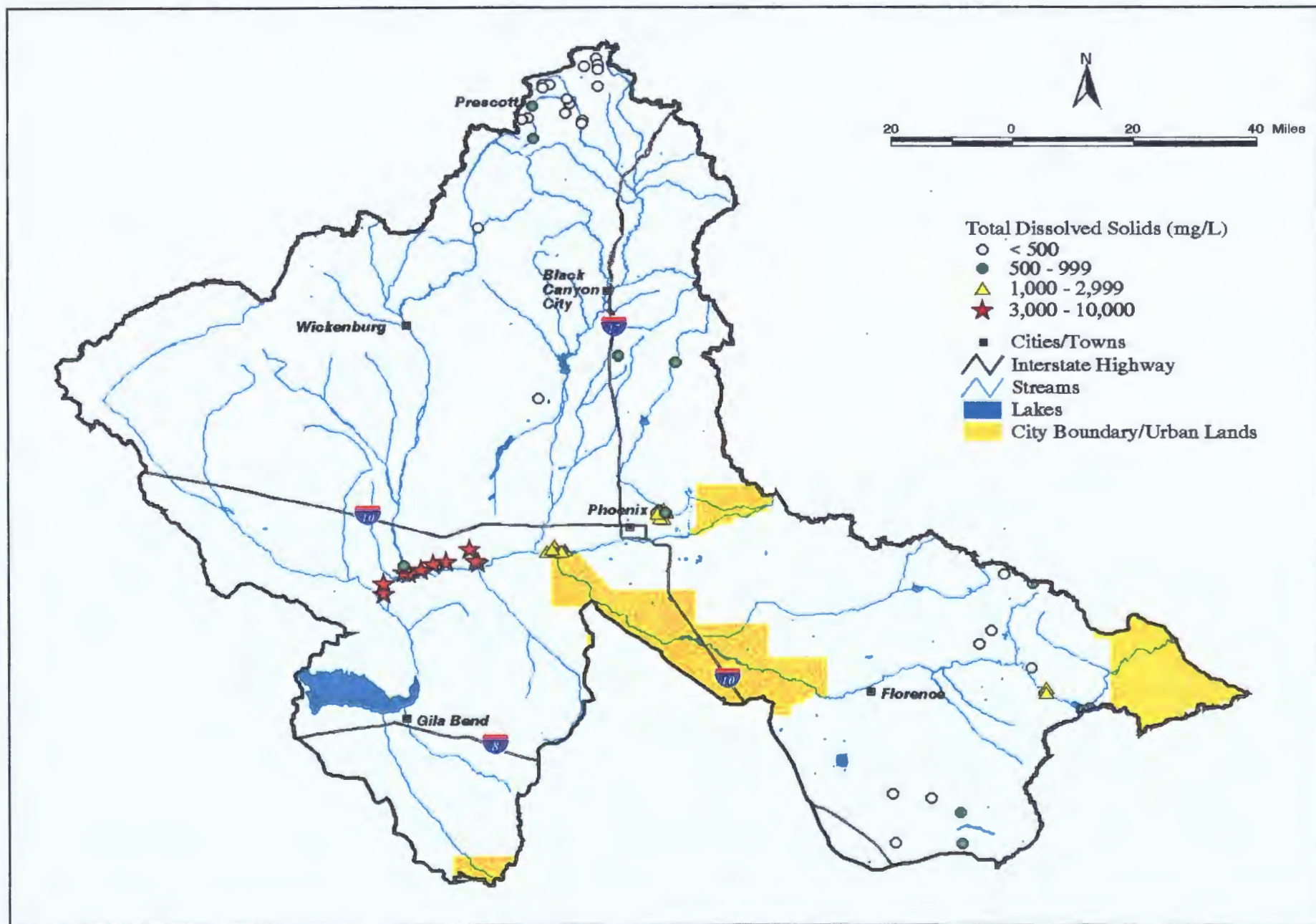


Figure 31. Classification of Ground Water Quality by TDS Concentration in the Middle Gila Watershed

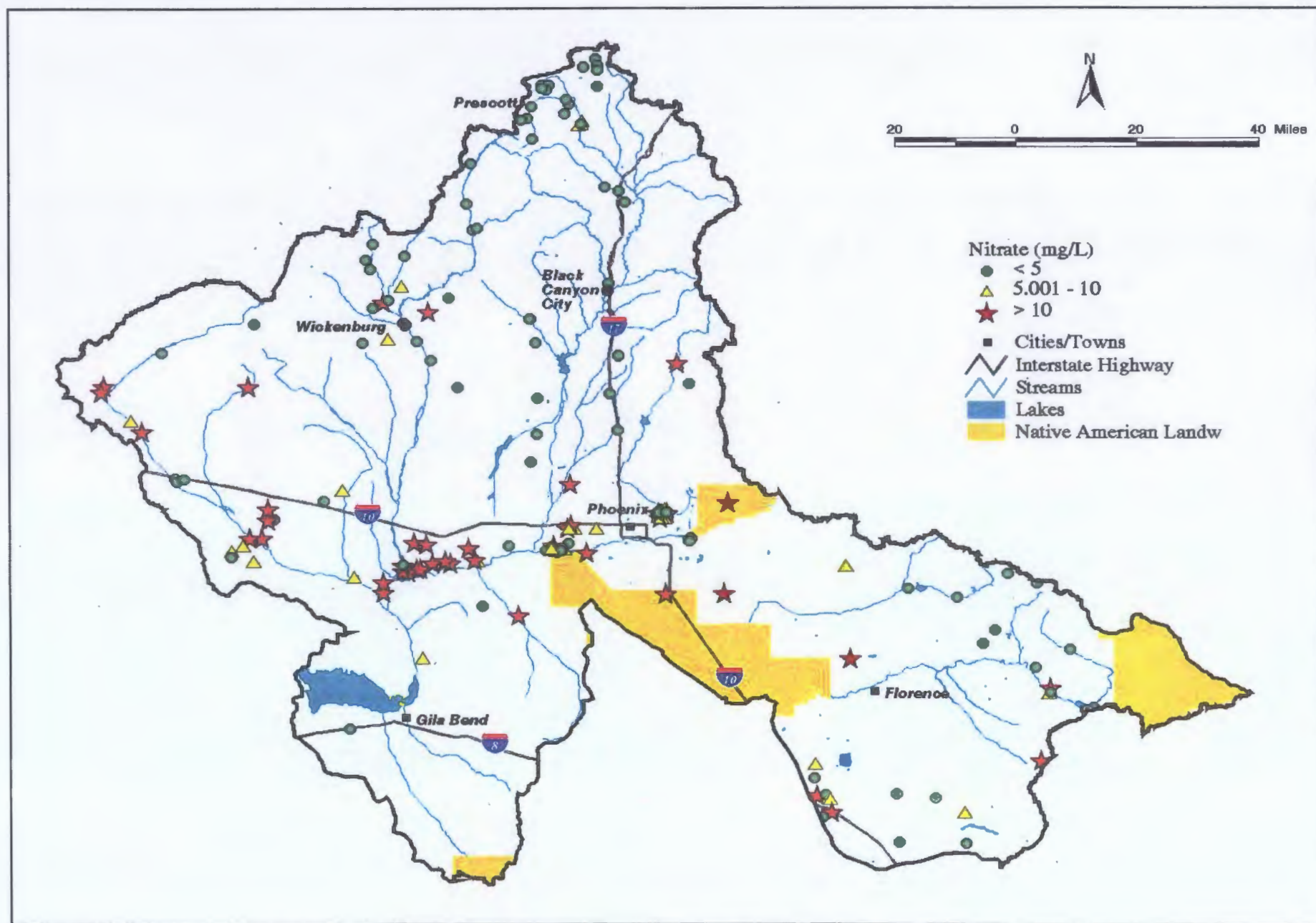


Figure 32. Classification of Ground Water Quality by Nitrate Concentration in the Middle Gila Watershed

Watershed Studies and Alternative Solutions in the Middle Gila Watershed

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Middle Gila Watershed. Watershed partnerships active in this watershed are also mentioned.

Surface Water Studies and Mitigation Projects

Total Maximum Daily Load Studies – Several TMDL studies have been initiated in this watershed. Most are in the initial monitoring and modeling stage. Further information about the status of any of these TMDLs can be obtained by contacting the TMDL Program at (602) 771-4468 or through ADEQ's web site at: <http://www.adeq.state.az.us/environ/water/assess/tmdl.html>

- **Hassayampa River Study** – The segment of the Hassayampa River from its headwaters to Blind Indian Creek, near the town of Wagoner, is included in this study area. The TMDL will determine the sources of cadmium, copper, and zinc. Several abandoned mines and tailings piles are located in this Hassayampa drainage area. One tailings pile is actually on the water's edge at the old Senator Mine.
- **Turkey Creek Study** – A segment from its headwaters to Poland Creek is on the 303(d) List due to arsenic, cadmium, copper, cyanide, lead, and zinc. An active mine (The Golden Turkey Mine) and numerous abandoned mines are in this drainage area. The US Forest Service and EPA are cooperating with ADEQ in collecting samples, with seven different sample locations to determine the extent and possible sources of these pollutants.
- **French Gulch Study** – French Gulch is a small tributary to the Hassayampa River which is on the 303(d) List due to: cadmium, copper, manganese, pH and zinc. The study area includes the inactive Zonia Mine and numerous abandoned mines. ADEQ is coordinating with Arimetco Inc., the current owner of the Zonia Mine, who is already submitting quarterly sample results for French Gulch under a compliance order. Three different sample locations below the Zonia Mine are being used to determine the extent and possible sources of pollutants.

Middle Gila River Pesticides Studies – Previous studies of fish and wildlife tissue contamination have lead to the issuance of fish consumption advisories due to four banned pesticides: DDT, toxaphene, dieldrin, and chlordane (Kepner, 1987; ADHS, 1991). Two studies have been completed to determine the status of wildlife contamination.

- U.S. Fish and Wildlife Service collected fish tissue and sediment samples in 1994 and 1995 (King, et al., 1997) along the Gila River to compare levels of pesticide and metals with the previous USFWS study in 1985 (Kepner, 1987). The new report concluded that residues of DDT have declined over the last decade but remain extremely high when compared to national averages. DDE residues were greatest in fish from agricultural drains, particularly Buckeye Canal and Dysart Drain. The number of pesticides detected in biota have also declined dramatically, with six detected in 1994-1995 versus 16 compounds in 1985.

Eleven potentially toxic metals were detected in fish tissue. Most metals concentrations remained unchanged from the previous study. Copper concentrations in 65% of fish exceeded the national average.

Generally, softshell turtles were more contaminated with pesticides and metals than fish. Concentrations of mercury and selenium were relatively low and do not pose a threat to fish. The greatest potential impact of contaminants is to top-level predators such as black-crowned night-herons, potentially impacting their reproductive systems.

Although this study focused on contaminant threats to fish and wildlife, hazards to human health were also obvious. Potentially health threatening levels of DDE were present in fish fillets from Buckeye Canal and Painted Rock, exceeding the screening levels proposed by EPA and ADEQ for the protection of human health. None of the fish fillet samples exceeded the EPA guidance level for mercury. However, higher levels of mercury were found in Painted Rock Bass fillets than from Bass samples collected in the late-1980s.

- During 1999, fish tissue samples were collected by the ADEQ's Priority Pollutant Program at three sites on the Middle Gila River between Phoenix and Gillespie Dam to measure pesticide contamination levels. These samples revealed considerably lower DDT concentrations than were found in previous studies of the area; however, DDT levels were above EPA's screening concentration levels. Also, some individual samples contained high concentrations of toxaphene. Dieldrin was not found above detection levels. The recommendations generated by this study are to keep the fish advisories on the Middle Gila for DDT and toxaphene. It was also recommended that the dieldrin consumption advisory be rescinded.

The US Fish and Wildlife Service Contaminant Study of Mineral Creek – Fish and sediments were collected in 1993 and 1995 in the lower reaches of Mineral Creek, a tributary to the Gila River in Pinal County (Andrews and King, 1997). Habitat quality and fish population diversity and abundance were also assessed to determine possible negative impacts on wildlife due to discharges from Ray Mine. Despite elevated concentrations of copper, lead, and zinc in sediment and some fish samples, the overall ecology of Mineral Creek improved from 1993 to 1995. Cleanup efforts by the mine improved ecological conditions of Mineral Creek, and by 1995, four species of fish were present in the area that was nearly devoid of fish only two years earlier.

Federal Permits and Compliance Monitoring – EPA and ADEQ have required several federal permit holders in this watershed (NPDES and 404 permits) to do instream water quality monitoring to determine the effectiveness of permit restrictions and remediation actions.

- The ASARCO Ray Mine complex, located along Mineral Creek, is the second largest copper mining operation in Arizona covering approximately 20-25 square miles. The 122 square mile Mineral Creek drainage area flows through this mine site. A dam about 1.5 miles above the open pits area slows surface water flow and runoff, then a tunnel diverts the flow around the open pits, returning the flow to its channel above some of the leaching facilities.

A joint ADEQ/EPA Consent Decree in 1998 required that ASARCO build a new tunnel to divert flow from above the "Pearl Handle Pit," a large open pit mine area, into the old diversion tunnel. The new tunnel, which is nearly complete in 2001, will also divert water flow away from some of the leaching facilities located upstream of the large

open pit mine area. Mineral Creek was also concrete-lined below the old tunnel in 2001 to prevent any potential leaching contaminants from large heap leach piles to percolate into the stream channel. This consent decree occurred because of 47 point source discharges reported from August 1988 through November 1997 that have threatened water quality in Mineral Creek and violated EPA's NPDES permit conditions and the Arizona's Aquifer Protection Permit regulations. Several of the discharges have resulted in surface water quality violations for copper, pH, beryllium and cadmium. Ground water generally has cadmium and fluoride exceedances at the proposed Point of Compliance but no determination has yet been made as to whether these are natural or due to mine discharges.

Five sample sites have been established by ASARCO to ascertain the water quality impacts to Mineral Creek potentially caused by their operation. Data from these five sample sites were used to assess Mineral Creek.

- At Indian Gardens, above the active mining operations. This site was established to determine natural background and contributions from upstream abandoned mines.
- Above Pearl Handle Pit and the old diversion tunnel, downstream of the "4D" waste rock deposition area and several small heap leach piles and adits. The new diversion tunnel will divert flow around this site into the old tunnel. Also, an interceptor well and pump were installed in 1998 just above this sample point.
- At the bottom end of the old diversion tunnel.
- Downstream of the old diversion tunnel outlet. This portion of Mineral Creek was channelized with concrete (finished in 2001).
- Below the Highway 177 bridge, and just above the Gila River. This lower portion of Mineral Creek once again becomes a natural drainage channel.

- BHP Copper Inc. mining along Queen Creek – A storm water NPDES permit requires the mine to measure metals concentrations at two points on Queen Creek, submit a Best Management Practices plan and implement it. In June of 2000, ADEQ also recommended updating bioassessment monitoring requirements to the NPDES Permit, and these changes were incorporated into the permit. Starting in August 2000, BHP Copper Inc., agreed to take action to remove acid-generating

waste rock from contact with storm water run-off.

- City of Tempe for Tempe Town Lake in the Salt River – The Tempe Town Lake, approximately 220 acres in size, is the newest of the urban lakes in the Middle Gila watershed. This artificial lake with two inflatable rubber dams was first filled with water in June 1999. As a condition of their 404 and 401 permits Tempe is required to sample the lake's water quality monthly. Five sample points have been established. Based on more than a year of sampling the only two constituents found to be in exceedance of state surface water standards were high pH and low dissolved oxygen. Both of these conditions are typical for urban impoundments in the Phoenix-metro area and have also been observed due to seasonal algae blooms and lake turnover.

Salt River Project (SRP) Routine Monitoring – Two rivers (the Salt and Verde), the Central Arizona Project (CAP) canal, and ground water are the source waters to SRP's canal system which supplies drinking water and irrigation water to much of the Phoenix metropolitan area. SRP conducts routine monitoring of all of these sources and shares its water quality information with its users, shareholders, and other interested parties.

Besides naturally occurring minerals, the canals were sampled for a variety of pollutants including metals, pesticides and VOCs. The samples are taken monthly as a grab sample, providing a snapshot of water quality in each canal sampled. Water quality can and does vary due to the volume and mixture of water from these sources varying seasonally, the amount and quality of agricultural return flows, Urban storm water runoff, evaporation, and seepage.

Water Protection Fund Projects – The following projects received Water Protection Funds from the Arizona Department of Water Resources.

- Picacho Reservoir Riparian Enhancement Project – Completed in 2000, this project enabled Pinal County to purchase sufficient quantities of Central Arizona Project (CAP) water over a 15-20 year period and enhance the 2,400-acre riparian and wetland habitat that currently exists within Picacho Reservoir. The habitat was periodically threatened by lack of water caused by irrigation draw-down and drought. Under this grant, Pinal County was able to establish a minimum pool within the reservoir to provide protection and enhancement of wildlife and aquatic resources.
- Assessment of the Role of Effluent Dominated Rivers in Supporting

Riparian Functions – Arizona State University researchers studied sites along six reaches of three Arizona streams (two reaches per stream), where both an effluent dominated Section and a natural perennial section existed. The study concentrated on one of the selected streams and compared some of the functions of the riparian ecosystem along the effluent-dominated and non-effluent dominated reaches. The objective was to determine whether there were differences in ecosystem responses between effluent-dominated reaches and non-effluent dominated reaches. This project was completed in 1997.

- Tres Rios River Management and Constructed Wetlands Project – The Tres Rios project encompasses 5,600 acres along a portion of the Salt and Gila rivers, extending from 83rd Avenue to a downstream point at the Agua Fria River. Based on a feasibility study by the Army Corps of Engineers, this project is to establish a constructed wetland that will provide critical riparian and wetland habitats that have been lost due to water diversions and resource development in the Phoenix metropolitan area.
- Tres Rios Wetland Heavy Metal Bioavailability Design for Denitrification and Microbial Water Quality – The City of Phoenix received Watershed Protection Funds to investigate three issues identified during operation of the Tres Rios Wetland Demonstration Project:
 - ▶ Are heavy metals in the wetlands bioavailable and are there operational strategies that would mitigate or exacerbate this phenomena?
 - ▶ What is the contribution of autotrophic bacteria to the overall denitrification efficiency of the wetland and can this information be used to better estimate wetland surface area requirements? and
 - ▶ Are bacteria/pathogen concentrations due to wildlife inputs or re-growth, and what is the survivability of pathogens in a constructed wetland?

Sampling and analysis of water, sediment, vegetation and fish tissue will be conducted to achieve the project objectives, and the findings of this study will be presented in an interpretative final report in 2001 or early 2002.

- Queen Creek Restoration and Management Plan – The town of Superior received funds to develop a Queen Creek restoration and management plan for the Queen Creek corridor. That corridor extends from its headwaters in the Tonto National Forest, through the town of Superior to the Boyce Thompson Southwestern Arboretum. The plan will address restoration of stream flow and riparian vegetation, and technical studies will be conducted to determine riparian vegetation water needs and channel flood conveyance capacity. The project was completed in 1999.
- Wickenburg High School Stream Habitat Creation – Wickenburg Unified School District was funded to add a recirculating stream to a wastewater treatment wetland. This would provide additional aeration to the open water portion of the treatment wetland. The applicant also proposes to create a riparian and xero-riparian vegetative community at the 15-acre project site. Over 800 mesquite, willow and cottonwood trees will be planted as well as a native shrub/scrub mixture. Basic monitoring will be conducted by students as part of the educational component of this project. The project is to be completed in 2003.
- Rio Salado Habitat Restoration Project -- The city of Phoenix Parks and Recreation Department received funds to create a vegetation demonstration project that would:
 - ▶ Test the performance of various plant materials planned for use in the greater Rio Salado project under various supplemental irrigation strategies and
 - ▶ Evaluate the treatment quality of the created wetlands for treating storm water, one of the water sources of the project.

The greater Rio Salado project will create authentic Sonoran Desert riparian habitat, adapted for the highly altered Salt River channel as it passes through Phoenix. Phoenix will create a low-flow channel to alleviate plant kill associated with long-term inundation and to provide opportunity for aquatic strand/shrub habitat types. An estimated 5.82 million gallons per day of water will be needed to support the habitats and maintain the perennial stream in the low-flow channel.

Ground Water Studies and Mitigation Projects

The Prescott Active Management Area Baseline Monitoring Study –

Situated in Yavapai County, the Prescott Active Management Area encompasses more than 485 square miles. (See discussion of Active Management Areas and ground water basins in Section II of this report.) This AMA is situated in both the Middle Gila and Verde watersheds. ADEQ conducted baseline monitoring in 1997-1998 to look at the heavy reliance on ground water supplies, ground water management decrees which require reaching sustainable levels (safe-yield) by 2025, a large increase in population, and the associated number of wells used to extract ground water.

The Prescott AMA consists of two sub-basins, (the Little Chino and the Upper Agua Fria), and two aquifers (the regional aquifer located in valley alluvial areas and the hardrock aquifer located in mountainous areas). Ground water quality differences were found between each sub-basin and each aquifer.

The study concluded that the 58 sites sampled in the Prescott AMA generally met water quality standards. Of the sites, 90 percent sampled met health-based standards and 85 percent met aesthetics-based standards. Aquifer protection standards were exceeded at scattered well sites and did not appear to indicate extensive areas of ground water that are unsuitable for domestic use. Fluoride and arsenic were the parameters that most frequently exceeded standards and these elevated levels appear to be the result of naturally occurring conditions.

Salt River Project (SRP) Ground Water Monitoring – (See prior discussion)

SRP's 248 ground water wells help satisfy customer needs in Phoenix metropolitan area. SRP ground water is pumped from wells into canals or laterals, where mixing and dilution with surface water occurs. SRP tests for organic, inorganic constituents, and trace metals.

Prescott Mining Project – This EPA funded study was to characterize the impacts to surface and ground water from inactive and abandoned mines within a 500 square mile area located in the Bradshaw Mountains, Yavapai County, Arizona. The US Forest Service, the U.S. Bureau of Mines, and ADEQ cooperated in this investigation. As a result of the partnership, the project was modified to focus on inactive and abandoned mining impacts on water quality and biota in the lower Turkey Creek drainage area.

In 1994-1995, 25 sites were sampled up to three times in the lower Turkey Creek

drainage area. Surface and ground water samples, geophysical surveys, and tailings (soil) samples were collected. Samples taken directly from the tailings piles indicated extremely high levels of arsenic and lead; however, water samples taken directly below these tailings piles and downstream did not reveal elevated levels of heavy metals during the three sampling events. A previous study at the Golden Turkey Mine in 1991 (a large abandoned mine along Turkey Creek) detected exceedances for arsenic, cyanide and mercury. This Prescott Mining Study concluded that the tailings do represent a significant potential source of contamination to Turkey Creek, which may only occur during rainfall/runoff events. Further, transport of these pollutants downstream to the Agua Fria River and Lake Pleasant pose a potential threat to human health and the environment.

The report recommended that the Golden Belt and Golden Turkey mines should be the first priority for remediation in the lower Turkey Creek drainage area. Since project and equipment costs can be significant, that remedial action should be undertaken after assessments of risk is completed at other mine sites in the vicinity. Further, a study should be initiated to determine impacts of downstream migration of contaminated sediments.

Federal and State Superfund Cleanup Sites – Seven federal National Priority Listed Superfund sites, nineteen state WQARF Superfund sites, and three Department of Defense cleanup sites are located in the Middle Gila Watershed. **Figure 63b** illustrates the location of these sites. These impacts to the Middle Gila Watershed's ground water quality cannot be understated.

- ▶ 19th Avenue Landfill and the Hassayampa Landfill – Two sites are landfills that have impacted ground water and soil. Volatile organic chemicals are present in the ground water beneath each landfill and other pollutants are in the soils, including petroleum products, pesticides and heavy metals.
- ▶ North Indian Bend Wash and South Indian Bend Wash -- These two sites are the result of historical industrial operations where volatile organic chemical solvents have contaminated ground water and created large plumes, spreading beyond the points of each spill site. The ground water in the southern site is mainly contaminated with volatile organic chemicals, while soils are contaminated by VOCs cyanides, acids, and heavy metals including chromium and lead. Efforts are ongoing to remediate and remove the TCE contamination with soil vapor extraction systems, air-stripping, and ground water treatment

systems.

- ▶ Motorola 52nd Street – This National Priority List site is located in a residential and commercial area in the eastern portion of Phoenix. The major contaminant of concern is the solvent TCE, a volatile organic compound which has formed a large plume in the ground water spreading to the west. Motorola is to design and implement a ground water and soil gas treatment system. Seven other parties have received general notice letters from ADEQ under the Superfund law as potentially responsible parties. This has lead one of those to conduct a remedial investigation of various volatile organic compounds, freon, and co-mingled jet fuel near Sky Harbor Airport. At the time of this writing, ADEQ is in the process of conducting a five year-review of data collected in one portion of this site to evaluate the effectiveness of current remedial actions.
- ▶ Luke Air Force Base, former Williams Air Force Base, and the Phoenix-Goodyear Airport north and south -- Three sites are located at either military or civilian airports. The contaminants include organic solvents and paint strippers, waste oil spills, petroleum spills, metal plating wastes, hydraulic fluids, pesticides, and radiological wastes. Contamination occurred due to historic disposal and storage practices.
- ▶ Seventeen other sites have impacted ground water with volatile organic chemicals. The most common volatile organic chemicals in this group are: PCE (a common dry cleaning chemical) and TCE (formerly used in the computer manufacturing and other high tech industries). Some of these sites also have soil contamination, with constituents like pesticides, heavy metals and petroleum products.
- ▶ Vulture Mill -- Investigations at the Vulture Mill shows an average concentration of lead in the mill tailings of 5,000 mg/kg (parts per million). This exceeds Arizona's soil remediation standards of 400 mg/kg on residential property and 2000 on non-residential property. The highest concentration of lead in the tailings is reported to be approximately 11,000 µg/L.
- ▶ East Washington Fluff sites – This site is listed for lead and polychlorinated biphenyls (PCBs) above regulatory levels. ADEQ initiated an early response action for the this former auto shredder facility. Contaminated soil was removed, and clean fill and gravel was

placed on top as a protective cap.

- The Gila Bend Auxiliary Air Field -- In 1994, the US Air Force conducted site investigations of two sites at this facility: the former fire training area and a nearby maintenance area. Limited contamination was found at the former fire training area, with a determination that it did not pose a threat to ground water. Sampling of the maintenance area did not reveal any contamination warranting further action.
- The 161st Air National Guard -- Past aircraft maintenance and fueling operations at the site have led to surface and subsurface soil and ground water contamination with petroleum products and volatile organic compounds.
- The Papago Military Reservation -- This site is listed due to jet fuel; however, the extent of contamination remains undefined.

Watershed Partnerships

The Upper Agua Fria Watershed Partnership -- This partnership was formed in 2000 under ADWR's Rural Watershed Initiative. This partnership is made up of supporting federal and state agencies and stakeholder groups, including: the Bureau of Land Management, the Natural Resources Conservation Service, US Fish and Wildlife Service, US Forest Service, US Geological Survey, ADEQ, ADWR, Arizona Game and Fish Department, Arizona State Land Department, Arcosanti, Big Bug Economic Alliance, Big Bug Watershed Group, Mothers for Clean Water, Sonoran Audubon Society, Spring Valley Homeowners Association, University of Arizona and Yavapai County Water Advisory Committee.

Three key watershed issues have been identified by the partnership: water quantity, water quality, and water legal rights issues. Specific issues included the fast growth and development of the Prescott Active Management Area (AMA), ranching issues, leaking underground storage tanks, and potential MTBE pollution near Cordes Junction. The issue of diminished water quality due to illegal wildcat dumps near and in the river systems has become very important, and the partnership plans to address this issue with a Water Quality Improvement Grant in 2001 to clean up several small wildcat dump sites along the Big Bug Creek and the Agua Fria River.

The UAFWP received \$25,000 in 2000 from the ADWR and State Legislature Rural Watershed Alliance Funds to conduct and compile a hydrological assessment of the Upper Agua Fria Sub-watershed (not including areas within the Prescott or Phoenix Active Management Areas). The research is being conducted by the University of Arizona's School of Renewable Resources. The report is to be finalized in the near future.

The partnership also received \$25,000 (2001) from the Rural Watershed Alliance Funds for a ground water study by University of Arizona for the Upper Agua Fria Sub-watershed, to help augment the on-going hydrologic study already being conducted.

Recently the partnership was successful in working with ADEQ and Yavapai County to have several tons of soil with asphalt chunks removed from Big Bug Creek. This occurred because the partnership brought the recent deposit of these waste materials in Big Bug to the attention of ADEQ and Yavapai County.

For information about future meeting, contact Mary Hoadley at earthhous@aol.com or by phone at Arcosanti, Arizona (520) 632-6229.

The Tres Rios River Management Plan Steering Committee -- The Tres Rios group was formed in 1994. The planning, design, and implementation phase of the Tres Rios Project required the cooperation of a large number of federal, state, city, and county agencies and other interested parties, including: Phoenix, the Corps of Engineers, the Bureau of Land Management, Glendale, Mesa, Phoenix, Scottsdale, Tempe and Tolleson, Arizona Municipal Water Users Association, Arizona State University, Gila River Indian Community, Greeley and Hansen, Maricopa County Flood Control District, and Science Applications International Corporation, Arizona Game and Fish Department, ADEQ, Maricopa County Department of Parks and Recreation, Maricopa County Flood Control District, and the United States Environmental Protection Agency.

The Tres Rios Project is a constructed wetland at the convergence of the Salt, Gila, and Agua Fria rivers (tres rios being Spanish for "three rivers"). It was conceived of so that the largest wastewater treatment plant serving the Phoenix metropolitan area could meet more stringent surface water quality standards and to provide additional treatment capacity. The wetlands were to provide water treatment for the 91st Avenue WWTP, create wildlife habitat, and provide for flood protection for downstream residents.

The objectives of the first phase of the Tres Rios Project were to:

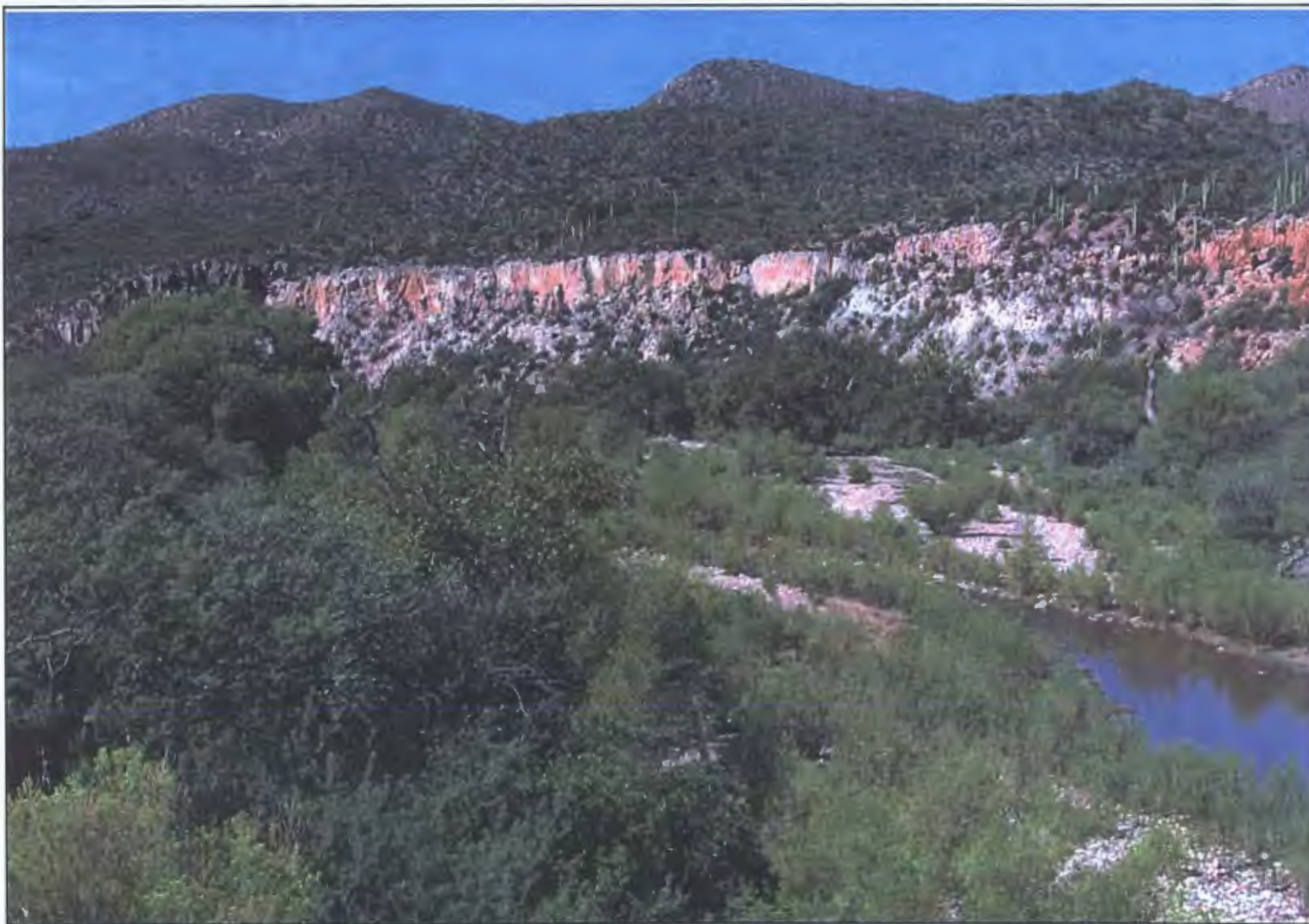
- ▶ Test the capability of constructed wetlands to treat effluent to meet the expected future National Pollutant Discharge Elimination System (NPDES) requirements,
- ▶ Develop appropriate design criteria for a future full-scale 800-acre wetland project in the Tres Rios area, which would treat the entire 150 million gallons per day of effluent discharged by the plant, and
- ▶ Assess the net environmental benefit it would have on the three river area.
- ▶ Enhance wildlife habitat,
- ▶ Provide an education and passive recreation resource for the community.

Along with the development of this constructed wetland, this interagency committee has:

- ▶ Developed a database of existing water quality data (inorganics, organic, pesticides, PCBs, and dissolved oxygen)
- ▶ Identified potential water quality sources of contaminants: flood flows, agricultural storm water runoff, agricultural irrigation drainage and dewatering, discharges from concentrated animal feeding operations, wastewater treatment plant discharges, landfill leachate, ground water inflow, and sand and gravel releases.
- ▶ US Army Corps of Engineers prepared the *Tres Rios, Arizona Feasibility Study* (2000). The study focused on efforts to improve fish and wildlife habitat values and diversity for threatened and endangered species. Potential incidental benefits for flood damage reduction, water quality, water supply and recreation were also evaluated.
- ▶ Two Geographic Information System (GIS) projects have been completed in 2001 by two private consultants to help characterize the Tres Rios area, the confluence of the Middle Gila, the Salt and the Agua Fria rivers. These GIS projects attempted to inventory the various elements that could potentially impair the rivers water quality, including NPDES permitted sites, Concentrated Animal Feeding Operations (CAFOs) and storm water inputs. These GIS projects are available on CD-ROM.

The main contact for this group is Dick Perault with the Maricopa County Flood Control District.

Salt Watershed



SALT WATERSHED CHARACTERIZATION

SIZE	6,242 square miles (5% of the State's land area).			
POPULATION BASE	Approximately 40,500 people live in this watershed (estimated from the 2000 census). This is approximately 1% of the state's population.			
LAND OWNERSHIP (Figure 33)	Tribal U.S. Forest Service	49% 47%	Private Other state and federal	2% 2%
LAND USES AND PERMITS (Figure 34)	Except for the Miami-Globe mining district, the basin is sparsely populated. Principal land uses on National Forest lands are recreation, grazing, and silviculture, with mining centralized in the Superior-Miami-Globe area. There are nine designated wilderness areas in this basin with restricted land uses and activities.			
HYDROLOGY AND GEOLOGY	<p>This watershed is defined by the Salt River drainage area from its headwaters to Granite Reef Dam, excluding the Verde River drainage area. The Salt River drainage area below Granite Reef Dam is included in the Middle Gila Watershed because the water in the Salt River is normally diverted at Granite Reef Dam into a system of canals and becomes hydrologically disconnected from its natural fluvial system. The watershed contains four surface water sub-basins: White River, Black River, Tonto River, and the Salt River. The perennial water in the White River and Black River sub-basins provides much of the water used in the Phoenix metropolitan area. Flow in the Salt River above Roosevelt Lake varies between 59 cfs (in 1955) to 143,000 cfs (in 1993), with an average annual flow of 929 cfs (USGS 1996).</p> <p>Ground water basins include: Tonto Creek Basin and the Salt River Basin, with a very small portion of the Phoenix Active Management Area. This watershed is primarily within the Central Highlands Province. The western portion of this watershed consists of rugged mountains, composed of igneous, metamorphic, and sedimentary rocks along with unconsolidated sediments that accumulate in the larger valleys. Groundwater occurs to some extent in these formations, although the amount varies widely depending on composition and structure of the rocks. Unconsolidated sands and gravel, which occur within the flood plain of streams and washes, are generally the most productive aquifers (ADWR 1994). The eastern portion of this watershed is dominated with volcanic materials such as basalt flows, cinder beds, tuffaceous agglomerates, and tuffs. Limited amounts of groundwater occur most predominately in cinder beds, fracture zones, and weathered zones (ADWR 1994). Due to the high elevations, steep gradients, and a predominance of hardrock, the entire watershed has high runoff and minimal natural water storage capabilities. Therefore the area is very susceptible to both drought and heavy groundwater pumping (ADWR 1994).</p>			
UNIQUE WATERS	None			
ECOREGIONS	Arizona-New Mexico Mountains			
OTHER STATES, NATIONS, OR TRIBES	<p>This watershed drains to the Middle Gila Watershed.</p> <p>White Mountain Apache, San Carlos Apache, and Salt River Indian tribes are significant stakeholders in this watershed as they own 49% of the land area.</p>			

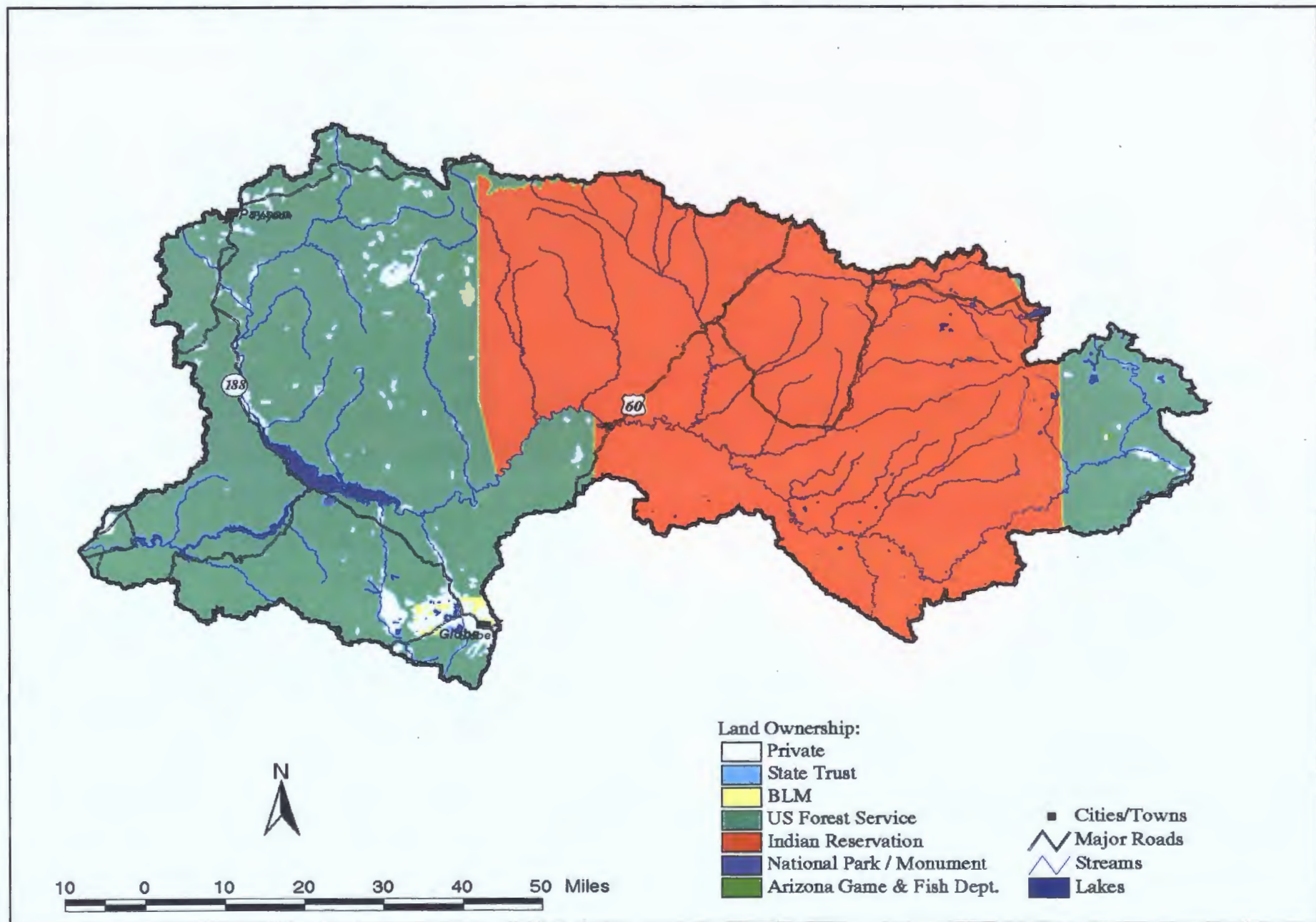


Figure 33. Land Ownership in the Salt Watershed

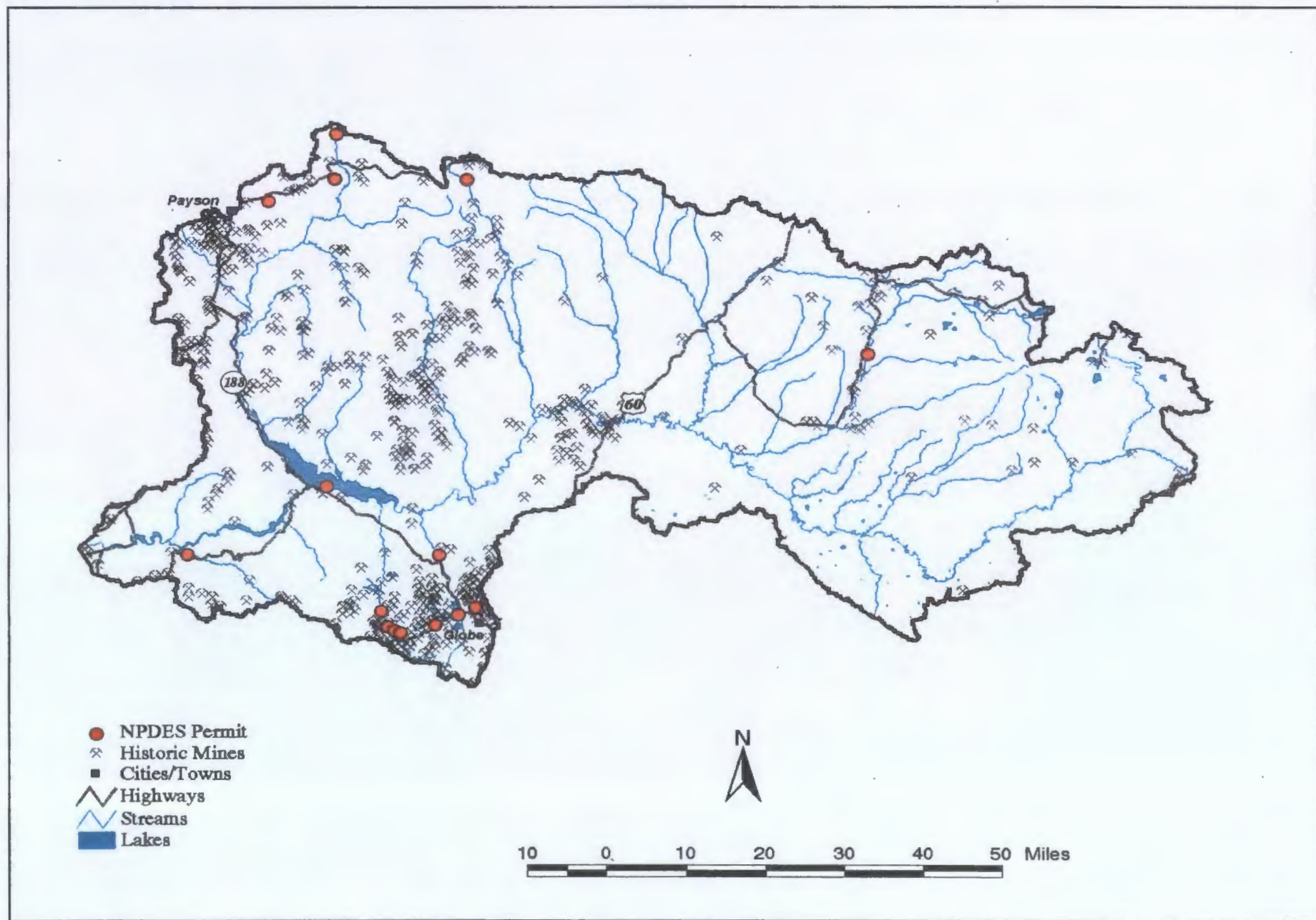


Figure 34. General Land Use and NPDES Permits in the Salt Watershed

Salt Watershed Assessment Discussion

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 193 miles of streams or washes, and 22,186 acres of lakes were assessed. Fewer assessment were completed than previously because of two factors: 1) changes in assessment criteria requiring more data to base an assessment, and 2) a lack of current credible data. This watershed will have additional water quality monitoring collected in 2002 and this new data will be included in the next assessment cycle.

Water quality assessment information for the Salt Watershed is summarized in the following tables and illustrated on **Figure 35**.

Table 18. Assessments in the Salt Watershed – 2002

	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	64	5	1,022	1
INCONCLUSIVE	82	3	21,164	5
IMPAIRED	31	3	0	0
NOT ATTAINING	20	2	0	0
TOTAL ASSESSED	198	13	22,186	6

PERENNIAL SURFACE WATERS ASSESSED		STREAMS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	168	10	22,187	6

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial mileage although part of the reach may have ephemeral or intermittent flow.

Inconclusive Assessments – Surface waters with some monitoring data, but insufficient data to determine if a designated use is attaining or impaired, were added to the new Planning List. By the end of the next watershed monitoring cycle (scheduled in 2007), ADEQ expects to monitor these reaches and lakes so that all designated uses can be assessed during the following assessment cycle. Other lakes and streams which lack water quality monitoring data will be monitored depending on resources and priorities.

ADEQ will be working with US Geological Survey and the Arizona Game and Fish Department, so that their future monitoring will better support Arizona's surface water assessments.

Major Stressors – When a surface water is listed as impaired or not attaining a designated use, the pollutants or suspected pollutants causing the impairment are identified. The seven stream reaches assessed as impaired or not attaining a use can be divided into two groups based on pollutants and their probable sources:

- ▶ Historic mining activities have caused impairment Pinto Creek and its unnamed (Gibson Mine) tributary due to copper; and
- ▶ Turbidity exceeds standards along Tonto Creek and a tributary, Christopher Creek.

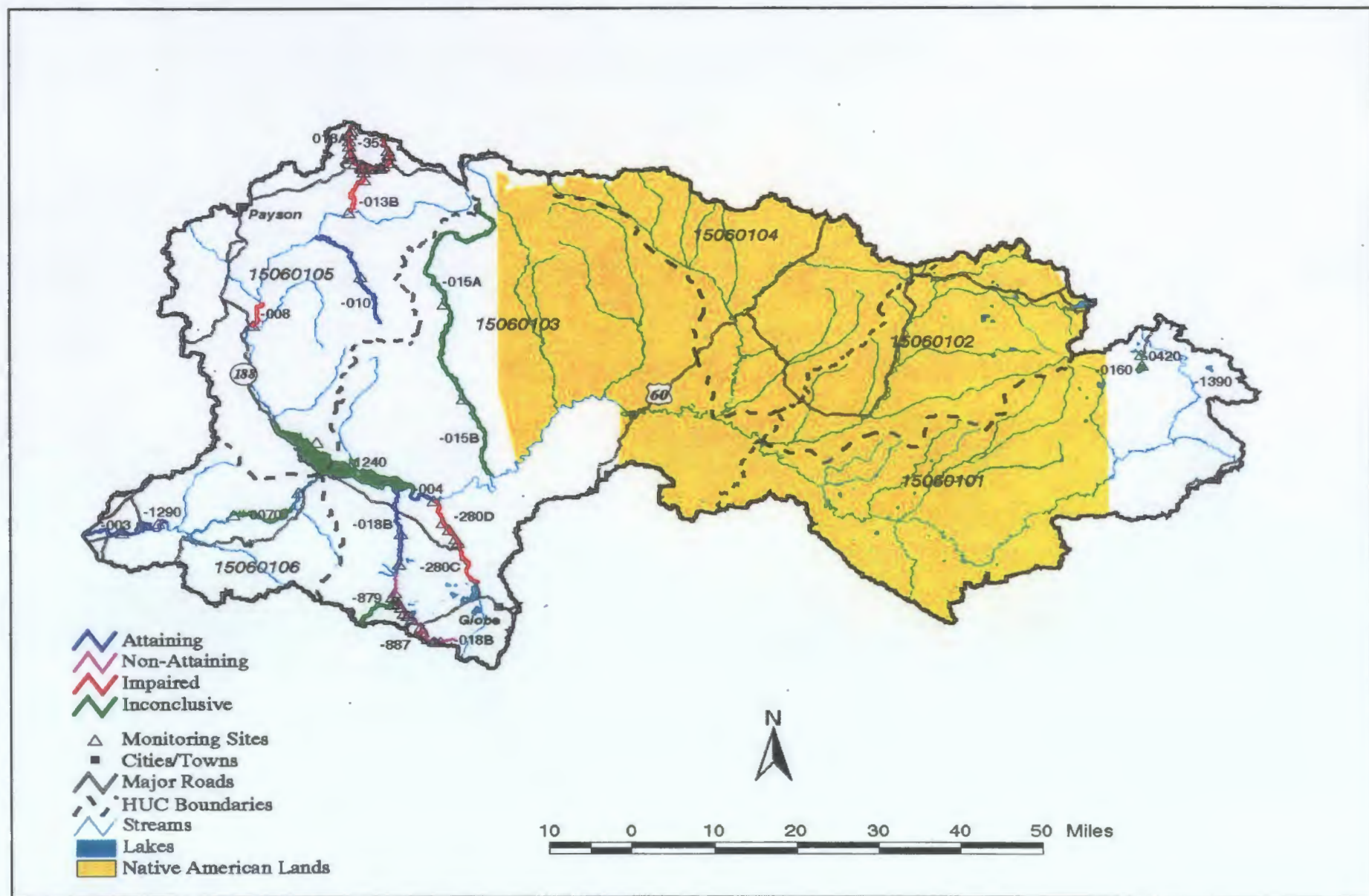


Figure 35. Salt Watershed 2002 Assessments

TABLE 19. SALT WATERSHED -- DATA MONITORING -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Bear Wallow Creek North Fork headwaters-Bear Wallow AZ15060101-022 A&Wc, FC, FBC, Agl, AgL	ADEQ Biocriteria Program Above South Fork Bear Wallow Creek SRNBE000.54 100605	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Black River West Fork headwaters-Black River AZ15060101-048 A&Wc, FC, FBC, DWS, Agl, AgL	ADEQ Biocriteria Program West Fork above Thompson Creek SRWFB011.08 100692	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Campaign Creek headwaters-Pinto Creek AZ15060103-037 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program At Superstition Wilderness boundary SRCGN007.70 100431	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Canyon Creek headwaters-Oak Creek AZ15060103-014 A&Wc, FC, FBC, DWS, Agl, AgL	ADEQ Biocriteria Program Above Valentine Canyon SRCYN031.50 100528	1997 - 1 suite	OK					
	Reach Summary Row	1997 1 sampling event	OK				Not assessed	Insufficient data to assess.
Cherry Creek headwaters-Salt River AZ15060103-015 A&Wc, FC, FBC, Agl, AgL	ADEQ Biocriteria Program Above Turkey Creek SRCHE024.73 100441	1997 - 1 suite	OK					Missing core parameters: some metals, bacteria, boron
	ADEQ Biocriteria Program Above Devil's Chasm SRCHE011.08 100442	1996 - 1 field + nutrients + NH3	OK					Missing core parameters: no metals, bacteria and boron
	Reach Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	1996 - 1997 2 sampling events Missing core parameters	OK				Inconclusive	ADEQ collected a total of 2 samples at two sites in 1996-1997. Reach is assessed as "Inconclusive" due to missing core parameters and lack of sampling events.

TABLE 19. SALT WATERSHED -- DATA MONITORING -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
Christopher Creek headwaters-Tonto Creek AZ15060105-353 A&Wc, FC, FBC, Agl, AgL	ADEQ Intensive Survey At See Springs (Headwaters) SRCRS003.26 100361	1996 - 2 suites, 1 bact	Ok					Missing core parameters: no boron or metals.
	ADEQ TMDL Program Upstream from recreation area SRCRS6.04 101027	2000 - 3 suites, 3 bact	Ok					
	ADEQ Intensive Survey Near See Springs Trail head parking - middle reference site SRCRS002.90 100436	1996 - 1 suite	Ok					
	ADEQ TMDL Program Downstream from recreation area SRCRS5.70 101028	2000 - 3 suites, 3 bact	Ok					
	ADEQ Intensive Survey Investigation Above Highway 260 SRCRS002.48 100362	1996 - 1 suite, 1 bact	Ok					
	ADEQ TMDL Program Above settlement of Christopher & Highway 260 Bridge SRCRS4.47 101029	2000 - 3 suites, 3 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.7 - 9.7	1 of 3		Missing core parameters: no boron or metals. Field staff documented that naturally occurring ground water upwelling rather than any anthropogenic activities caused the low dissolved oxygen; therefore, not considered in the final assessment.
	ADEQ Intensive Survey Investigation Below Christopher Creek Community SRCRS001.91 100363	1996 - 2 suites, 1 bact	Ok					Missing core parameters: no boron or metals.
	ADEQ TMDL Program By triangular cross-section cut through bedrock SRCRS3.56 101030	2000 - 3 suites, 3 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.7 - 10.4	1 of 3		Missing core parameters: no boron or metals. Low dissolved oxygen is naturally occurring (see note above).
	ADEQ Intensive Survey Investigation Above Campground SRCRS001.56 100364	1996 - 2 suites, 1 bact	Ok					Missing core parameters: no boron or metals.

TABLE 19. SALT WATERSHED -- DATA MONITORING -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	ADEQ TMDL Program Above Christopher Creek Camp and below Hunter Creek SRCRS2.85 101031	2000 - 3 suites, 3 bact	Turbidity NTU	10 (A&Wc)	0 - 12.73	1 of 3		
	ADEQ Intensive Survey Below Tonto Natl Forest Camp SRCRS001.27 100365	1996 - 2 suites, 1 bact	Ok					
	ADEQ TMDL Program Below Christopher Creek Camp above Boy Scout Ranch SRCRS2.26 101032	2000 - 3 suites, 3 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.6 - 8.1	1 of 3		Missing core parameters: no boron or metals. Low dissolve oxygen is naturally occurring (see note above).
			Turbidity NTU	10 (A&Wc)	0 - 13.97	2 of 3		Missing core parameters: no boron or metals.
	ADEQ Intensive Survey Below R-C Ranch SRCRS000.86 100366	1996 - 2 suites, 1 field (5 consecutive days of bacteria samples)	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.5 - 8.86	1 of 3		Missing core parameters: no boron or metals.
			Escherichia coli CFU/100 ml	580 (FBC) 130 Geometric mean (FBC)	68 - 3800 (978 geometric mean)	1 of 2 Geometric mean		Missing core parameters: no boron or metals.
			Turbidity NTU	10 (A&Wc)	1.61 - 894	1 of 2		Missing core parameters: no boron or metals.
	ADEQ TMDL Program At top of Box Canyon below RC Boy Scout Ranch SRCRS1.24 101033	2000 - 3 suites, 3 bact	Escherichia coli CFU/100 ml	580 (FBC)	1 - 689.3	1 of 3		Missing core parameters: no boron or metals.
			Turbidity NTU	10 (A&Wc)	0 - 88.63	2 of 3		
	ADEQ FSN Intensive Survey Below Box Canyon SRCRS000.18 100367	1996 - 1 suite 1999 - 1 nutrients	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.98 - 7.4	1 of 1		Missing core parameters: no boron or metals.
			Escherichia coli CFU/100 ml	580 (FBC)	430 - 600	1 of 1		
			Turbidity NTU	10 (A&Wc)	80 - 294	1 of 1		
	ADEQ TMDL Program Above Tonto Creek; Below Box Canyon SRCRS0.08 101034	2000 - 3 suites	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.3 - 7.7	1 of 3		Missing core parameters: no boron or metals. Naturally occurring low dissolved oxygen (see note above).
			Turbidity NTU	10 (A&Wc)	0 - 13.77	2 of 3		Missing core parameters: no boron or metals.

TABLE 19. SALT WATERSHED – DATA MONITORING – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row	1996 - 2000	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.5 - 10.4	2 of 38	Attaining	ADEQ collected a total of 39 samples at 16 sites in 1996-2000. Reach assessed as "impaired" due to turbidity. Add to Planning List due to bacteria exceedances and missing core parameters.
	A&Wc	39 sampling events Missing core parameters	Escherichia coli CFU/100 ml	580 (FBC)	1 - 3800	3 of 32	Attaining	
	FC			130 Geometric mean (FBC)	978	1 exceedance	Inconclusive	
	FBC Agl Agl		Turbidity NTU	10 (A&Wc)	0 - 894	9 of 32	Impaired	
Deer Creek headwaters-Rye Creek AZ15060105-018 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program At Mazatzal Wilderness Boundary SRD4E003.91 100531	1996 - 1 suite	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	3.2	1 of 1		Field staff documented that low dissolved oxygen at low flows (<0.1 cfs) is due to ground water upwelling (naturally occurring low DO) and not anthropogenic sources. Exceedance is not included in the final assessment.
	Reach Summary Row	1996 1 sampling event					Not assessed	Insufficient data to assess.
Devil's Chasm Creek headwaters-Cherry Creek AZ15060103-801 A&Wc, FC, FBC	ADEQ Biocriteria Program Above Cherry Creek SRDEV000.29 100533	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Fish Creek AZ15060106A-583 A&Ww, FC, FBC	ADEQ Biocriteria Program 0.25 miles upstream of Hwy 88 SRFSH004.06 100552	1997 - 1 suite	OK					
	Reach Summary Row	1997 1 sampling event	OK				Not assessed	Insufficient data to assess.
Fish Creek headwaters-Black River AZ15060101-032 A&Wc, FC, FBC, AgL, AgL	ADEQ Biocriteria Program Near Bear Wallow Wilderness SRFIS002.53 100553	1997 - 1 suite	Copper (dissolved) µg/L	varies with hardness (A&Wc)	<1.0 - 33	1 of 1		
	Reach Summary Row	1997 1 sampling event	Copper (dissolved) µg/L	varies with hardness (A&Wc)	<1.0 - 33	1 of 1	Not assessed	Insufficient data to assess. Add to Planning List due to copper exceedance.
Halgler Creek headwaters-Tonto Creek AZ15060105-012 A&Wc, FC, FBC, AgL, AgL	ADEQ Biocriteria Program 1.4 miles below Alderwood Recreation site SRHAG003.51 100563	1997 - 1 suite	OK					

TABLE 19. SALT WATERSHED -- DATA MONITORING -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row	1997 1 sampling event	OK				Not assessed	Insufficient data to assess.
Haunted Canyon headwaters-Pinto Creek AZ15060103-879 A&Ww, FC, FBC, Agl, AgL	ADEQ TMDL Program 0.25 miles below Powers Gulch above Pinto Creek SRHNC000.40 101131	2000 - 1 metals	OK					Missing core parameters. The beryllium sample from this site was excluded because the Laboratory Reporting Limit was higher than the standard.
	ADEQ TMDL Program Haunted Canyon at Carlota Weir HC-4 SRPNT000.20 101072	2000 - 1 metals	Beryllium µg/L	0.21 (FC)	0.58	1 of 1		Missing core parameters.
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	2000 2 sampling events Missing core parameters	Beryllium µg/L	0.21 (FC)	0.58	1 of 1	Inconclusive	ADEQ collected a total of 2 samples at 2 sites. Reach assessed as "Inconclusive" and should be added to the Planning List due to beryllium exceedance, missing core parameters, and lack of sampling events.
Hunter Creek AZ15060105-354 A&Wc, FC, FBC, AgL	ADEQ Fixed Station Monitoring Above Christopher Creek SRHUN000.07 100368	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling event					Not assessed	Insufficient data to assess.
Pinal Creek Jesse Lane-Salt River AZ15060103-280D A&Ww, FBC, FC, AgL (Reach segment shifted slightly from previous assessments. From new underground stream barrier and treatment plant outfall. Approximately where perennial flow historically began, down to Salt River. Due to outfall, perennial flow begins at outfall.) (Sites listed in order going downstream from the outfall site.)	USGS New treatment plant outfall	2000 - 3 suites	OK					Missing core parameters: turbidity, flow, bacteria, dissolved cadmium and chromium, total arsenic, beryllium, lead, copper, and mercury.
	Parametrix, Inc. for Pinal Creek Group just below outfall	2000 - 1 metals, pH 2001 - 1 metals, pH	OK					Missing core parameters: turbidity, flow, Escherichia coli.
	USGS Open File Report 97-247 At Head of Flow (HOF) SRPNL006.64	1996 - 6 suites 1997 - 6 suites 1998 - 5 suites 1999 - 7 suites	Copper (dissolved) µg/L	varies (65 max) (A&Ww)	<30 - 200	4 of 24		Results not included in the final assessment because samples were collected before new treatment methods were implemented. Other data supercedes this data.
			Fluoride mg/L	8.4 (FBC)	0.5 - 8.7	1 of 23		
			Manganese (total) µg/L	19,600 (FBC)	25000 - 66900	24 of 24		
			pH (Low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	5.4 - 6.5	23 of 24		

TABLE 19. SALT WATERSHED -- DATA MONITORING -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	USGS site 1.5	1999 - 1 suites	Manganese (total) µg/L	19,600 (PBC)	68300	1 of 1		Results not included in the final assessment because samples were collected before new treatment methods were implemented. Other data supercedes this data.
			pH (Low) SU	6.5 - 9.0 (A&Ww, AgL)	5.5	1 of 1		
			Zinc (dissolved) µg/L	varies (379 max) A&Ww	1510	1 of 1		
	USGS At Selka Ranch #09498380	1996 - 6 suites 1997 - 6 suites 1998 - 5 suites 1999 - 7 suites	Copper (dissolved) µg/L	varies (65 max) (A&Ww)	<10 - 283	14 of 24		Results not included in the final assessment because samples were collected before new treatment methods were implemented. Other data supercedes this data.
			Manganese (total) µg/L	19,600 (FBC)	66 - 74700	24 of 24		
			pH (Low) SU	6.5 - 9.0 (A&Ww, AgL)	5.5 - 7.5	23 of 24		
		2000 - 2 suites 2001 - 5 suites 2002 - 3 suites	OK					Missing core parameters: flow, turbidity, bacteria; dissolve cadmium, chromium, copper; total mercury, lead, beryllium, arsenic.
	Phelps Dodge/Pinal Creek Group WQARF Monitoring At See Ranch SRPNL004.68	1998 - 1 metals, pH 1999 - 12 metals, pH	Cadmium (total) µg/L	50 (AgL)	<1 - 55	1 of 13		Results not included in the final assessment because samples were collected before new treatment methods were implemented. Other data supercedes this data.
			Copper (dissolved) µg/L	varies (65 max) (A&Ww)	<10 - 140	5 of 13		
			Manganese (total) µg/L	19600 (FBC)	<50 - 74900	13 of 13		
			pH (Low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	5.4 - 7.2	12 of 13		
		2000 - 9 metals, pH 2001 - 7 metals, pH 2002 - 3 metals, pH	OK					Missing core parameters: flow, turbidity, bacteria, total mercury, arsenic, and chromium
	Hydro Geo Chem, Inc. for Pinal Creek Group Translator Site at Sees Ranch	2000 - 8 metals, pH 2001 - 2 metals, pH	OK					Missing core parameters: flow, turbidity, bacteria; total mercury, copper, and lead
	USGS site Z1	1998 - 1 suite 1999 - 1 suite	Copper (dissolved) µg/L	varies (65 max) (A&Ww)	30 - 220	1 of 2		Results not included in the final assessment because samples were collected before new treatment methods were implemented. Other data supercedes this data.
			Manganese (total) µg/L	19,600 (FBC)	57800 - 65600	2 of 2		
			pH (Low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	5.9 - 6.2	2 of 2		

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	USGS site Z2.2	2000 - 1 suite	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.7	1 of 1		Low dissolved oxygen is natural due to the presence of groundwater upwelling. Missing core parameters: turbidity, flow, bacteria, and all total metals
	USGS site Z4.	1998 - 1 suite	Copper (dissolved)	varies with hardness (A&Ww)	190	1 of 1		Results not included in the final assessment because samples were collected before new treatment methods were implemented. Other data supercedes this data.
			Manganese (total) mg/L	19600 (FBC)	57,600	1 of 1		
			pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	6.1	1 of 1		
			Zinc (dissolved)	varies with hardness (A&Ww)	1100	1 of 1		
		2000 - 1 suite	OK					Missing core parameters: turbidity, flow, bacteria, and all total metals
	Parametrix, Inc PNL 1B	2001 - 1 suite 2002 - 1 suite	OK					Missing core parameters: turbidity, flow, and bacteria.
	USGS site Z4.3	1999 - 1 suite 2000 - 1 suite (before treatment began)	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	0.9 - 3.6	2 of 2		Results not included in the final assessment because samples were collected before new treatment methods were implemented. Other data supercedes this data. Natural low dissolved oxygen due to ground water upwelling noted by field personnel and not included as an exceedance.
			Manganese (total) mg/L	19600 (FBC)	44900 - 49500	2 of 2		
			pH (low) SU	8.5 - 9.0 (A&Ww, FBC, AgL)	5.8 - 6.0	2 of 2		
	USGS site Z4.4	1999 - 2 suites 2000 - 1 suite (before treatment began)	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	0.5 - 3.7	3 of 3		Results not included in the final assessment because samples were collected before new treatment methods were implemented. Other data supercedes this data. Natural low dissolved oxygen due to ground water upwelling noted by field personnel and not included as an exceedance.
			Manganese (total) mg/L	19600 (FBC)	44100 - 52700	3 of 3		
			pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	5.9 - 6.0	3 of 3		

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	USGS site Z4.5	2000 - 1 suite (before treatment began)	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	3.2	1 of 1		Results not included in the final assessment because samples were collected before new treatment methods were implemented. Other data supercedes this data.
			Manganese (total) mg/L	19600 (FBC)	57900	1 of 1		Low dissolved oxygen is natural due to the presence of groundwater upwelling noted by field personnel and not included as an exceedance.
			pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	6.0	1 of 1		
	USGS site Z4.7	1999 - 1 suite	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	3.2	1 of 1		Results not included in the final assessment because samples were collected before new treatment methods were implemented. Other data supercedes this data.
			Manganese (total) mg/L	19600 (FBC)	52100	1 of 1		Low dissolved oxygen is natural due to the presence of groundwater upwelling noted by field personnel and not included as an exceedance.
			pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	6.0	1 of 1		
		2000 - 3 suites 2001 - 1 suite	pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	6.2 - 6.9	2 of 4		Exceedances only in the first 5 months of treatment.
	USGS site Z5	2000 - 4 suites 2001 - 4 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	4.4 - 7.2	2 of 6		Only manganese exceedance occurred in October 2000 before treatment initiated and was not included in this assessment
			Manganese (total) mg/L	19600 (FBC)	7100 - 57600	1 of 6		Low dissolved oxygen is natural due to the presence of groundwater upwelling, noted by field personnel and not included as an exceedance.
			pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	6.1 - 6.6	4 of 8		Low pH occurred only during the first 5 months after treatment was initiated. Missing core parameters: turbidity, flow, bacteria, and all total metals.
	USGS site Z5.7	2000 - 3 suites 2001 - 5 suites 2002 - 3 suites	Manganese (total) mg/L	19600 (FBC)	8700 - 54400	2 of 11		One manganese exceedances occurred in January 2000 before treatment was initiated and was not included in this assessment. Other exceedance occurred in January immediately after treatment began. Missing core parameters: turbidity, flow, bacteria, and all total metals

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STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	USGS site Z7	2000 - 3 suites 2001 - 5 suites 2002 - 1 suite	Manganese (total) mg/L	19600 (FBC)	5000 - 45900	2 of 9		One manganese exceedance occurred in October 2000 before treatment was initiated and was not included in this assessment. Other exceedance occurred in February 2 months after treatment began. Missing core parameters: turbidity, flow, bacteria, and all total metals.
	USGS site Z9a.	2000 - 4 suites 2001 - 5 suites 2002 - 3 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.5 - 8.0	1 of 6		Only manganese exceedance occurred in October 2000 before treatment was initiated and was not included in this assessment. Low dissolved oxygen is natural due to the presence of groundwater upwelling noted by filed personnel and not included as an exceedance .
			Manganese (total) mg/L	19600 (FBC)	2400 - 31200	1 of 6		Missing core parameters: turbidity, flow, bacteria, and all total metals.
	USGS site JJ15	2000 - 2 suites 2001 - 1 suite	OK					Missing core parameters: turbidity, flow, bacteria, and all total metals.
	Phelps Dodge/Pinal Creek Group At Pringle	1998 - 1 metals and pH 1999 - 12 metals and pH 2000 - 3 metals and pH (before treatment initiated)	Beryllium (total) µg/L	0.21 (FC) 4.0 (FBC)	5.0	2 of 2 2 of 2		Results not included in the final assessment because samples were collected before new treatment methods were implemented. Other data supercedes this data.
			Copper (dissolved) µg/L	varies with hardness (A&Ww)	<10 - 100	3 of 16		
			Manganese (total)	19600	<50 - 26200	3 of 16		
	Hydro Geo Chem, Inc for Pinal Creek Group At Inspiration Dam Translator site	2000 - 9 metals and pH 2001 - 12 metals and pH 2002 - 9 metals and pH	pH (low) SU	6.5 - 9.0 (A&Ww, FBC, AgL)	6.2 - 7.7	1 of 30		Missing core parameters: turbidity, bacteria,
			OK					Missing core parameters: turbidity, bacteria, and some metals
	Parametrix, Inc For Pinal creek Group PNL 3	2000 - 1 metals and pH 2001 - 2 metals and pH 2002 - 1 metals and pH	OK					Missing core parameters: turbidity, bacteria, and some metals

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Phelps Dodge/Pinal Creek Group At Inspiration Dam	1998 - 1 metals and pH 1999 - 12 metals and pH 2000 - 3 metals and pH (before treatment initiated)	Beryllium (total) µg/L	0.21 (FC) 4.0 (FBC)	5.0	2 of 2 2 of 2		Results not included in the final assessment because samples were collected before new treatment methods were implemented. Other data supercedes this data.
		2000 - 9 metals and pH 2001 - 7 metals and pH 2002 - 3 metals and pH	Copper (dissolved) µg/L	varies (65 max) (A&Ww)	<10 - 80	3 of 16		Core parameters missing: turbidity, bacteria, flow
			Ok					
	USGS At Inspiration Dam 100727	1996 - 6 suites 1997 - 6 suites 1998 - 5 suites 1999 - 4 suites	Beryllium (total) µg/L	0.21 (FC)	0.27 - 1.9	7 of 7		Results not included in the final assessment because samples were collected before new treatment methods were implemented. Other data supercedes this data.
			Manganese (total) µg/L	19600 (FBC)	180 - 53000	9 of 27		
			Turbidity NTU	50 (A&Ww)	0.19 - 140	1 of 26		
		2000 - 4 suites 2001 - 5 suites 2002 - 4 suites	Ok					All core parameters were tested.
	Parametrix, Inc For Pinal creek Group PNL 4 (high flow alternative to PNL 5)	2001 - 2 metals and pH	OK					Missing core parameters: turbidity, bacteria, and some metals
	Parametrix, Inc For Pinal creek Group PNL 5 near confluence with Salt River	2001 - 1 metals and pH 2002 - 1 metals and pH	OK					Missing core parameters: turbidity, bacteria, and some metals
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining Agl Attaining	2000 (after treatment initiated) - 2002 175 total samples >60 sampling events	Manganese (total) µg/L	19600 (FBC)	<50 - 57900	2 of 105	Attaining	This monitoring illustrates the successful implementation of technology-based treatment through Arizona's WQARF-Superfund Program to bring a surface water back into compliance with its standards! (See further discussion in the special studies section of this watershed report.) Three monitoring entities contracted by the Pinal Creek Group and USGS have been monitoring this creek before and after the treatment was implemented. The exceedances shown in the summary row occurred shortly after the treatment was initiated. All designated uses are assessed as attaining their uses.
			pH (low) SU	6.5 - 9.0 (A&Ww, FBC, Agl)	5.8 - 7.2	7 of 160	Attaining	

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Pinto Creek headwater-Ripper Spring AZ15060103-018A A&Ww, FC, FBC, Agl, AgL	ADEQ TMDL Program At Simpson Dam	2001 - 2 field, copper	OK					
	ADEQ TMDL Program Above Henderson Ranch Mines SRPNT023.02 101039	2001 - 1 suite, 3 field, copper	OK					
	ADEQ TMDL Program At Henderson Ranch Mines	2001 - 3 field, copper	OK					
	ADEQ TMDL Program Below Henderson Ranch Mines SRPNT022.89 101061	2001 - 1 suite, 3 field, copper	Copper (dissolved)	varies with hardness (A&Ww)	2 - 44	1 of 4		
			Zinc (dissolved)	varies with hardness (A&Ww)	390	1 of 1		
	ADEQ TMDL Program Above Gibson Mine Tributary SRPNT021.31 101062	2001 - 1 suite, 3 field, copper	Copper (dissolved) µg/L	varies with hardness (A&Ww)	17 - 40	3 of 4		
	ADEQ TMDL Program Below Gibson Mine Tributary SRPNT021.30 101063	2001 - 1 suite	Copper (dissolved) µg/L	varies with hardness (A&Ww)	560	1 of 1		
			Copper (total) µg/L	500 (AgL)	640	1 of 1		
	ADEQ TMDL Program At Old Highway 60 SRPNT020.65 101064	2001 - 1 suite	Copper (dissolved) µg/L	varies with hardness (A&Ww)	32 - 920	4 of 4		
			Copper (total) µg/L	500 (AgL)	810	1 of 4		
	ADEQ TMDL Program Above cactus breccia	2001 - 1 field, copper	Copper (dissolved)	varies with hardness (A&Ww)	33	1 of 1		
	ADEQ TMDL Program Below cactus breccia	2001 - field, copper	Copper (dissolved)	varies with hardness (A&Ww)	47	1 of 1		
	BHP Mining NPDES permit instream monitor Above Cottonwood Gulch AMP1	1997 - 1 field, 1 metals 1999 - 2 field, 2 metals 2000 - 1 field, 1 metals	OK					

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	BHP Mining NPDES permit instream monitor Above Cottonwood Gulch AMP2	1996 - 3 field, 3 metals 1999 - 2 field, 2 metals 2000 - 1 field, 1 metals	Copper (dissolved) µg/L	varies with hardness (A&Ww)	<20 - 110	1 of 6		
	BHP Mining NPDES permit instream monitor Below Cottonwood Gulch AMP3	1996 - 3 field, 3 metals 1999 - 3 field, 3 metals 2000 - 1 field, 1 metals	OK					
	BHP Mining NPDES permit instream monitor Below Miller Springs Gulch DW24	1998 - 2 field, 2 metals 1999 - 4 field, 4 metals 2000 - 3 field, 3 metals	OK					
	BHP Mining NPDES permit instream monitor Below DW24 Site PC2UP	1998 - 2 field, 2 metals 1999 - 4 field, 4 metals 2000 - 3 field, 3 metals	Beryllium µg/L	0.21 (FC)	<0.2 - 0.42	1 of 2		
	ADEQ TMDL Program At USGS Gage below Haunted Canyon SRPNT016.18 101068	2000 - 2 suites	OK					
	BHP Mining NPDES permit instream monitor Below Gold Gulch Weir & Haunted Canyon AMP4	1996 - 5 field, 6 metals 1997 - 2 field, 2 metals 1998 - 2 field, 2 metals 1999 - 4 field, 4 metals 2000 - 3 field, 3 metals	Beryllium µg/L	0.21 (FC)	<0.2 - 0.34	1 of 7		
			Turbidity NTU	50 (A&Ww)	0.64 - 56	1 of 13		
	Reach Summary Row	1996 - 2001*	Beryllium µg/L	0.21 (FC)	<0.2 - 0.42	2 of 20	Attaining	ADEQ & BHP's Consultant collected a total of 80 samples from 18 sites. Reach assessed as "not attaining" due to copper. A copper TMDL was approved by EPA in 2001. * Monitoring data collected in 2001 was included in this assessment because 2000 was an exceptionally dry year.
	A&Ww	Not attaining	Copper (dissolved) µg/L	varies with hardness (A&Ww)	<20 - 920	13 of 78	Not attaining	
	FC	Inconclusive	Copper (total) µg/L	500 (AgL)	640 - 810	2 of 78	Attaining	
	AgL	Attaining	Turbidity NTU	50 (A&Ww)	0.64 - 56	1 of 54	Attaining	
	AgL	Attaining	Zinc (dissolved)	varies with hardness (A&Ww)	390	1 of 58	Attaining	
Pinto Creek Ripper Spring-Roosevelt Lake AZ15060103-018B A&Ww, FC, FBC, AgL, AgL	ADEQ Fixed Station Monitoring At Henderson Ford West of Globe SRPNT007.13 100346	1996 - 4 suites 1997 - 3 suites 1998 - 3 suites 1999 - 3 suites 2000 - 4 suites	Turbidity NTU	50 (A&Ww)	0.27 - 180	1 of 17		

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ TMDL Program At USGS Gage near Pinto Valley Weir SRPNT011.44 101070	2000 - 1 suite 2001 - 4 suites	OK					
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining Agl Attaining AgL Attaining	1996 - 2001* 22 samples 19 sampling events	Turbidity NTU	50 (A&Ww)	0.27 - 180	1 of 19	Attaining	ADEQ collected a total of 19 total samples at two sites in 1996-2000. Reach assessed as "attaining all uses." (* Monitoring in 2001 was included in this assessment because 2000 was an exceptionally dry year.)
Pinto Creek's unnamed tributary (a.k.a. Gibson Mine tributary) headwaters-Pinto Creek AZ15050103-887 A&Ww, FC, FBC, Agl, AgL	ADEQ TMDL Program Gibson Mine Tributary SRGIB000.01 101071	2001 - 1 suite, 3 field + copper	Beryllium µg/L	0.21 (FC)	0.51	1 of 1		
			Copper (total) µg/L	500 (AgL) 5000 (AgL)	2100 - 6200	4 of 4 2 of 4		
			Copper (dissolved) µg/L	varies A&Ww)	2100 - 5900	4 of 4		
			pH SU	6.5-9.0 (A&Ww, FBC, AgL)	5.3 - 6.73	1 of 4		
			zinc (dissolved) µg/L	varies (A&Ww)	96	1 of 1		
	Reach Summary: A&Ww Not attaining FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	2001 4 sampling events	Beryllium µg/L	0.21 (FC)	0.51	1 of 1	Inconclusive	ADEQ collected 4 samples in 2001 (2001 data included in this assessment because previous years had been so dry.) Reach was assessed as "not attaining" as the approved TMDL on Pinto Creek also assigned a load to this tributary. That load is not yet being met. Also added to Planning List due to beryllium, pH, and zinc exceedances and lack of mercury and bacterial samples.
			Copper (total) µg/L	500 (AgL)	2100 - 6200	4 of 4	Inconclusive	
			Copper (total) µg/L	5000 (AgL)	2100 - 6200	2 of 4	Inconclusive	
			Copper (dissolved) µg/L	varies A&Ww)	2100 - 5900	4 of 4	Not attaining	
			pH SU	6.5-9.0 (A&Ww, FBC, AgL)	5.3 - 6.73	1 of 4	Inconclusive	
			zinc (dissolved) µg/L	varies (A&Ww)	96	1 of 1	Inconclusive	
Reservation Creek headwaters-Black River AZ15060101-010 A&Wc, FC, FBC, Agl, AgL	ADEQ Biocriteria Program Above Black River SRRES000.30 100629	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Reynolds Creek headwaters-Salome Creek AZ15060103-202 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Below McFadden Creek SRREY000.70 100630	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Salome Creek headwaters-Roosevelt Lake AZ15060103-022 A&Wc, FC, FBC, Agl, AgL	ADEQ Biocriteria Program Below Little Turkey Creek SRSAL014.92 100636	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
Salt River Pinal Creek-Roosevelt Lake AZ15060103-004 A&Ww, FC, FBC, Agl, AgL	USGS Station #09498500 Above Roosevelt Lake SRSLR055.32 100745	1996 - 11 field 1997 - 13 field 1998 - 11 suites 1999 - 4 suites 2000 - 8 suites, 4 bact	Beryllium µg/L	0.21 (FC)	<0.1 - 0.6	1 of 13		
			Nitrogen (total) mg/L	2.0 (A&Ww)	0.16 - 2.1	1 of 47		
			Turbidity NTU	50 (A&Ww)	0.57 - 220	1 of 13		
	Reach Summary Row A&Ww Attaining FC Attaining FBC Attaining Agl Attaining AgL Attaining	1996 - 2000 47 sampling events	Beryllium µg/L	0.21 (FC)	<0.1 - 0.6	1 of 13	Attaining	USGS collected 47 samples in 1996-2000. Reach assessed as "attaining all uses."
			Nitrogen (total) mg/L	2.0 (A&Ww)	0.16 - 2.1	1 of 47	Attaining	
			Turbidity NTU	50 (A&Ww)	0.57 - 220	1 of 13	Attaining	
Salt River Saguaro Lake-Verde River AZ15060106A-003 A&Wc, FC, FBC, DWS, Agl, AgL	AGFD Below Stewart Mountain Dam SRSLR027.30	1999 - 2 field, 2 nutrient 2000 - 1 field, 1 nutrient	OK					
	SRP Below Stewart Mountain Dam WSRVSL2 SRSLR030.22	1996 - 12 suites 1997 - 12 suites 1998 - 11 suites 1999 - 12 suites 2000 - 14 suites, 9 pesticides	Copper (dissolved) µg/L	varies with hardness (A&Ww)	11 - 110	1 of 61		
	USGS Station #09502000 Below Stewart Mountain Dam SRSLR033.55	1999 - 2 suites, 2 bact 2000 - 6 suites, 6 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.1 - 9.4	2 of 8		

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Reach Summary Row	1996 - 2000	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	4.1 - 10.3	2 of 11	Attaining	AGFD collected 3 samples in 1999-2000. SRP collected 61 samples in 1996-2000. USGS collected 8 samples in 1999-2000. Reach assessed as "attaining all uses."
	A&Wc Attaining FC Attaining FBC Attaining DWS Attaining Agl Attaining AgL Attaining	72 sampling events	Copper (dissolved) µg/L	varies with hardness (A&Ww)	11 - 110	1 of 61	Attaining	
Snake Creek headwaters-Black River AZ15060101-045 A&Wc, FC, FBC, DWS, Agl, AgL	ADEQ Biocriteria Program Near Bear Wallow Wilderness SRSNK001.19 100643	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Spring Creek headwaters-Tonto Creek AZ15060105-010 A&Wc, FC, FBC, AgL	ADEQ Fixed Station Monitoring SRSP1006.79 100380	1996 - 6 suites	OK					Only 2 bacterial samples
	Reach Summary Row A&Wc Attaining FC Attaining FBC Inconclusive AgL Attaining	1996 6 sampling events Missing core parameter (bacteria)	OK				Attaining	ADEQ collected 6 samples in 1996. Reach assessed as "attaining some uses." Could not assess Full Body Contact due to insufficient bacteria samples.
Stinky Creek headwaters-West Fork Black River AZ15060101-352 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Below Forest Road 116 SRST1001.76 100652	1998 - 1 suite	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.54	1 of 1		Naturally occurring low dissolved oxygen due to ground water upwelling and low flow. Not included in the final assessment.
	Reach Summary Row	1998 1 sampling event					Not assessed	Insufficient data to assess.
Tonto Creek headwaters-Haigler Creek AZ15060105-013 A&Wc, FC, FBC, AgL	ADEQ Intensive survey At Headwater Spring Above AGFD Fish Hatchery SRTON043.98 100350	1999 - 1 nutrient	OK					
	ADEQ TMDL Program At Headwater Spring Above AGFD Fish Hatchery SRTON073.00 101016	2000 - 3 suites, bact	OK					
	ADEQ Intensive survey Below AGFD Fish Hatchery SRTON043.52 100351	1999 - 1 nutrient	OK					

TABLE 19. SALT WATERSHED -- DATA MONITORING -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ TMDL Program Below AGFD Fish Hatchery SRTON72.66 101017	2000 - 3 suites, bact	OK					
	ADEQ TMDL Program Above Baptist Camp and Dick Williams Creek SRTON71.72 101018	2000 - 3 suites, bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.75 - 8.8	1 of 3		Field staff documented that the low dissolved oxygen was due to naturally occurring low DO in ground water up welling in the stream and not due to any anthropogenic activities. Exceedances not considered in the final assessment
	ADEQ TMDL Program Below Baptist Camp road bridge SRTON70.86 101019	2000 - 3 suites, bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.7 - 9.1	1 of 3		Naturally occurring low dissolved oxygen (see comment above)
	ADEQ TMDL Program Above Horton Creek confluence SRTON69.87 101020	2000 - 3 suites, 3 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.4 - 17.1	1 of 3		Naturally occurring low dissolved oxygen (see comment above)
			Escherichia coli CFU/100ml	580 (FBC)	12 - 658.6	1 of 3		
	ADEQ TMDL Program Below Horton Creek confluence SRTON69.80 101021	2000 - 2 suites, 2 bact	OK					
	ADEQ TMDL Program Above Kohls Ranch & Highway 260, USGS Gage site SRTON68.95 101022	2000 - 3 suites, 3 bact	Turbidity NTU	10 (A&Wc)	3.42 - 19.8	1 of 3		
	ADEQ TMDL Program Below Kohls Ranch Above Tontozona SRTON68.00 101023	2000 - 3 suites, 3 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.0 - 10.0	1 of 3		
			Turbidity NTU	10 (A&Wc)	5.69 - 28.5	2 of 3		
	ADEQ Intensive Survey Above Christopher Creek SRTON038.98 100359	1996 - 1 suite, 1 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.29 - 7.06	1 of 1		
			Turbidity NTU	10 (A&Wc)	19.5 - 22.7	1 of 1		
	ADEQ TMDL Program Above Christopher Creek SRTON66.90 101024	2000 - 3 suites, 3 bact	Turbidity NTU	10 (A&Wc)	8.81 - 54.5	3 of 3		

TABLE 19. SALT WATERSHED -- DATA MONITORING -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	ADEQ Intensive Survey Below Christopher Creek SRTON038.81 100360	1996 - 1 suite, 1 bact 2000 - 6 suites, 5 bact	Beryllium µg/L	0.21 (FC)	0.89	1 of 1		4 other beryllium samples were not used because the Laboratory Reporting Limit was too high to assess Fish Consumption.
			Turbidity NTU	10 (A&Wc)	1.36 - 78.4	3 of 6		
	ADEQ Intensive Survey Above Bear Flats south of Kohls Ranch SRTON038.32 100357	1996 - 3 suites, 2 bact	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.48 - 9.7	1 of 3		Sampled on 5 consecutive days with monsoon rains. These 4 consecutive samples were counted as one sampling event.
			Escherichia coli CFU/100ml	580 (FBC)	8 - 1400	1 of 2		
			Turbidity NTU	10 (A&Wc)	3.34 - 261	1 of 2		
	ADEQ TMDL Program Above Bear Flats Residence area, below Christopher Creek SRTON65.38 101025	2000 - 3 suites, 3 bact	Turbidity NTU	10 (A&Wc)	21.8 - 98	3 of 3		
	ADEQ TMDL Program Below Bear Flats Residence area access road SRTON64.22 101026	2000 - 3 suites, 3 bact	Turbidity NTU	10 (A&Wc)	28.43 - 101.4	3 of 3		
	ADEQ Fixed Station Monitoring Below Bear Flats south of Kohls Ranch SRTON037.17 100358	1996 - 1 suite	OK					
	Reach Summary Row	1999 - 2000 44 samples 11 sampling events	Beryllium µg/L	0.21 (FC)	0.89	1 of 1	Inconclusive	ADEQ collected a total of 44 samples from 17 sites. Reach assessed as "Impaired" due to turbidity. Also, add to Planning List due to beryllium exceedance.
	A&Wc Impaired FC Inconclusive FBC Attaining Agl Attaining Agl Attaining		Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.0 - 17.1	3 of 44	Attaining	
			Escherichia coli CFU/100ml	580 (FBC)	8 - 1400	2 of 41	Attaining	
			Turbidity NTU	10 (A&Wc)	1.36 - 261	23 of 43	Impaired	
Tonto Creek Haigler Creek-Spring Creek AZ15060105-011 A&Wc, FC, FBC, Agl, AgL	ADEQ Biocriteria Program At Hellsgate, below Haigler Cr. SRTON032.31 100669	1997 - 1 suite	OK					
	Reach Summary Row	1997 1 sampling event	OK				Not assessed	Insufficient data to assess.

TABLE 19. SALT WATERSHED -- DATA MONITORING -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Tonto Creek Rye Creek-Gun Creek AZ15060105-008 A&Wc, FC, FBC, Agl, AgL	ADEQ Fixed Station Monitoring Above USGS gage @ Jakes Corner SRTON015.88 100349	1996 - 5 suites 1997 - 4 suites 1998 - 4 suites 1999 - 3 suites 2000 - 4 suites	Turbidity NTU	10 (A&Wc)	0.5 - 36.2	7 of 20		
	Reach Summary Row A&Wc Impaired FC Attaining FBC Attaining Agl Attaining Agl Attaining	1996 - 2000 20 sampling events	Turbidity NTU	10 (A&Wc)	0.5 - 36.2	7 of 20	Impaired	ADEQ collected 20 samples in 1996-2000. This reach of Tonto Creek was assessed as "Impaired" by turbidity.
Workman Creek, headwaters-Salome Creek AZ15060103-195 A&Wc, FC, FBC, Agl, AgL	ADEQ Biocriteria Program Below Workman Creek Falls SRWRK005.34 100696	1996 - 1 suite	OK					
	Reach Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient data to assess.
LAKE MONITORING DATA								
Apache Lake AZL15060106A-0070 A&Wc, FC, FBC, DWS, Agl, AgL	AGFD Routine Monitoring 3 sites combined SRAPA	1996- 2 field, 2 NH3, 2 nutrient	OK					Missing most core parameters
	ADEQ Clean Lakes Program SRAPA 100008	1996 - 1 suite	OK					Missing core parameters: bacteria
	Reach Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive Agl Inconclusive Agl Inconclusive	1996 - 1999 3 sampling events Missing core parameters	OK				Inconclusive	ADEQ and AGFD collected a total of 3 samples in 1996-1999. Lake assessed as "Inconclusive" and added to the Planning List due to a lack of core parameters.
Big Lake AZL15060101-0160 A&Wc, FC, FBC, DWS, Agl, AgL	AGFD Routine Monitoring SRBIG	1996 - 2 field, 2 NH3, 2 nutrient 1997 - 1 field, 1 NH3, 1 nutrient	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.4 - 8.3	1 of 3		Missing most core parameters.
	Reach Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive Agl Inconclusive Agl Inconclusive	1996 - 1997 3 sampling events Missing core parameters	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.4 - 8.3	1 of 3	Inconclusive	AGFD collected 3 samples in 1996-1998. Lake assessed as "Inconclusive" and added to the Planning List due to missing core parameters.
Canyon Lake AZL15060106A-0250 A&Wc, FC, FBC, Agl, AgL	AGFD Routine Monitoring 3 sites combined SRCAN	1998 - 1 suite	OK					
	Reach Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.

TABLE 19. SALT WATERSHED -- DATA MONITORING -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Crescent Lake AZL15060101-0420 A&Wc, FC, FBC, Agl, AgL	AGFD Routine Monitoring SRCRE	1996 - 3 field, 3 NH3, 3 nutrients 1997 - 1 suite 1998 - 2 suites 1999 - 1 suite	pH (high) SU	6.5 - 9.0 (A&Wc, FBC, Agl, AgL)	7.97 - 10.1	5 of 7		Missing core parameters: turbidity, flow, dissolved metals, boron, bacteria, arsenic, beryllium, copper, lead, mercury.
	ADEQ Lakes Program SRCRE-B 100993	1999 - 1 suite	pH (high) SU	6.5 - 9.0 (A&Wc, FBC, Agl, AgL)	9.64 - 9.83	1 of 1		Missing core parameters: bacteria, total manganese and beryllium
			Nitrogen (total) mg/L	2	2.05	1 of 1		
	Reach Summary Row	1996 - 1999	pH (high) SU	6.5 - 9.0 (A&Wc, FBC, Agl, AgL)	7.97 - 10.1	6 of 8	Inconclusive	ADEQ & AGFD collected a total of 8 samples from 2 sites in 1996-1999. Lake assessed as "Inconclusive" and should be added to the Planning List due to pH and nitrogen did not meet standards and missing core parameters.
	A&Wc Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	8 sampling events Missing core parameters	Nitrogen (total) mg/L	2	2.05	1 of 1	Inconclusive	
Roosevelt Lake AZL15060103-1240 A&Ww, FC, FBC, DWS, Agl, AgL	AGFD Routine Monitoring Dam Site SRROO	2000 - 8 suites	OK					At all four AGFD monitoring sites: 1. Missing core parameters: turbidity, bacteria, fluoride, barium, beryllium, dissolved metals, boron, lead. 2. Mercury Laboratory Reporting Limit is not low enough to assess Fish Consumption.
	AGFD Routine Monitoring Salt Arm Site SRROO	2000 - 7 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.6 - 13.15	1 of 7		
	AGFD Routine Monitoring Tonto Arm Site SRROO	2000 - 6 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.32 - 9.64	1 of 8		
	AGFD Routine Monitoring Windy Hill Site SRROO	2000 - 3 suites	OK					
	ADEQ Clean Lakes ProgramSRROO-A 100075	1996 - 1 suite 2000 - 1 suite	OK					Missing core parameters: bacteria, boron, beryllium
	ADEQ Clean Lakes ProgramSRROO-B 100076	1996 - 1 suite 2000 - 1 suite	OK					
	ADEQ Clean Lakes ProgramSRROO-C 100077	1996 - 1 suite 2000 - 1 suite	OK					
	ADEQ Clean Lakes ProgramSRROO-D 100078	1996 - 1 suite	OK					
	ADEQ Clean Lakes Program SRROO-E 100079	1996 - 1 suite	OK					

TABLE 19. SALT WATERSHED -- DATA MONITORING -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY AND PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	Reach Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive Agl Inconclusive AgL Inconclusive	1996 - 2000 34 samples 10 sampling events Missing core parameters	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.32 - 13.15	2 of 33	Inconclusive	ADEQ & AGFD collected a total of 34 samples at 8 sites in 1996 & 2000. Lake assessed as "Inconclusive" due to missing core parameters.
Saguaro Lake AZL15060106A-1290 A&Wc, FC, FBC, DWS, Agl, AgL	ADEQ Lakes Program SRSAG-BJ 100081	1999 - 1 suite	Dissolved Oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.07 - 8.11	1 of 1		Low dissolved oxygen attributed to natural lake turnover of the water column in October, a seasonal condition. Not used in the final assessment.
	ADEQ Lakes Program SRSAG-A 100082	1996 - 1 suite 1999 - 1 suite 2000 - 1 suite	Dissolved Oxygen mg/L	7.0 (90% saturation) (A&Wc)	5.63 - 10.49	1 of 3		Naturally occurring low dissolved oxygen (see note above).
	ADEQ Fixed Station Monitoring Lakes Program At Marina SRSAG-MAR1 100994	2000 - 1 VOCs	OK					Missing core parameters: bacteria
	ADEQ Lakes Program SRSAG-MAR2 100995	1999 - 1 field 2000 - 1 VOCs, 1 inorganics						
	ADEQ Lakes Program SRSAG-BAG 101001	1999 - 1 suite						
	AGFD Routine Monitoring Above Bagley Flats SRSAG	1999 - 6 field, 6 NH3, 6 nutrients 2000 - 2 field, 2 NH3, 2 nutrients	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	8.1 - 9.85	1 of 8		Naturally occurring low dissolved oxygen (see note above).
	AGFD Routine Monitoring Peregrine Cove SRSAG	1999 - 6 field, 6 NH3, 6 nutrients 2000 - 2 field, 2 NH3, 2 nutrients	Dissolved oxygen mg/L	7.0 (90% saturation) (A&Wc)	6.2 - 10.02	1 of 8		Naturally occurring low dissolved oxygen (see note above).
	AGFD Routine Monitoring Dam site SRSAG	1999 - 5 field, 5 NH3, 5 nutrients 2000 - 2 field, 2 NH3, 2 nutrients	OK					Missing core parameters: turbidity, metals, bacteria, boron, fluoride, barium
	Reach Summary Row A&Wc Attaining FC Attaining FBC Inconclusive DWS Attaining Agl Attaining AgL Attaining	1996 - 2000 29 sampling events Missing core parameters	OK				Attaining	ADEQ & AGFD collected a total of 29 samples from 8 sites in 1996-2000. Lake assessed as "attaining some uses." Add to Planning List due to missing bacteria samples.

Information for Interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from combining the following: AZ (for streams) or AZL (for lakes) + a US Geological Survey Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses," "Agency," and "Units" (of measurement) abbreviations are defined in Appendix A.

- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year" is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
 - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among the many monitoring entities that provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
 - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
 - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."
 - Although many parameters may be analyzed, only those exceeding a standard are shown. Other parameters were collected.
 - "OK" indicates that no standards were exceeded.
 - The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
 - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
 - A mean, geometric mean, or median will be shown along with the range of results if applicable to the standard or assessment criteria.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or "Inconclusive." See assessment criteria in Chapter III of Volume I.

Ground Water Assessments in the Salt Watershed

Major Ground Water Stressors -- Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 20** and illustrated in **Figure 36, 37, and 38**.

As **Table 20** indicates, only 17 wells were sampled. Among these wells, the only constituents with standards analyzed were fluoride, metals, and nitrates. This is not enough water quality information to base a groundwater assessment; however, it should be noted that among those samples, no standards were exceeded.

TDS Concentrations -- Water quality can be characterized based on concentration of Total Dissolved Solids (TDS). No TDS water quality standards apply in this watershed; however, elevated salinity limits the practical uses of ground water as TDS over 500 mg/L has an off-flavor, and TDS over 1000 mg/L will limit its use for some crops. In this watershed, TDS was monitored only in two wells (**Figure 37**). This is not enough samples to characterize water quality.

Nitrate Concentrations -- Water quality can also be characterized by looking at the concentration of nitrate in ground water (**Figure 38**). Naturally occurring nitrate concentrations in ground water are generally below 3 mg/L. Concentrations above 5 mg/L indicate potential anthropogenic sources of nitrate. Of the 17 wells monitored for nitrate, two exceeded this 5 mg/L concentration (12% of the wells). Exceedances may be related to historic irrigated agriculture or septic systems.

When nitrate concentrations exceed 10 mg/L, Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health, as water with nitrate greater than 10 mg/L may present a health problem for babies and should not be consumed by nursing mothers. None of the 17 wells monitored exceeded 10 mg/L. However, efforts should be taken to minimize further contamination of ground water by nitrate.

Table 20. Salt Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	0		--	--
	Fluoride	0		--	--
	Metals/Metalloids	0		--	--
	Nitrate	0		--	--
	VOCs + SVOCs*	0	--	--	--
	Pesticides	0	--	--	--
TARGETED MONITORING WELLS	Radiochemicals	0		--	--
	Fluoride	17		0	0%
	Metals/metalloids	17		0	0%
	Nitrate	17		0	0%
	VOCs + SVOCs*	0	--	--	--
	Pesticides	0	--	--	--

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells (all targeted wells)	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
2	2	0	0	0

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells (all targeted wells)	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
17	15	2	0

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.

*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

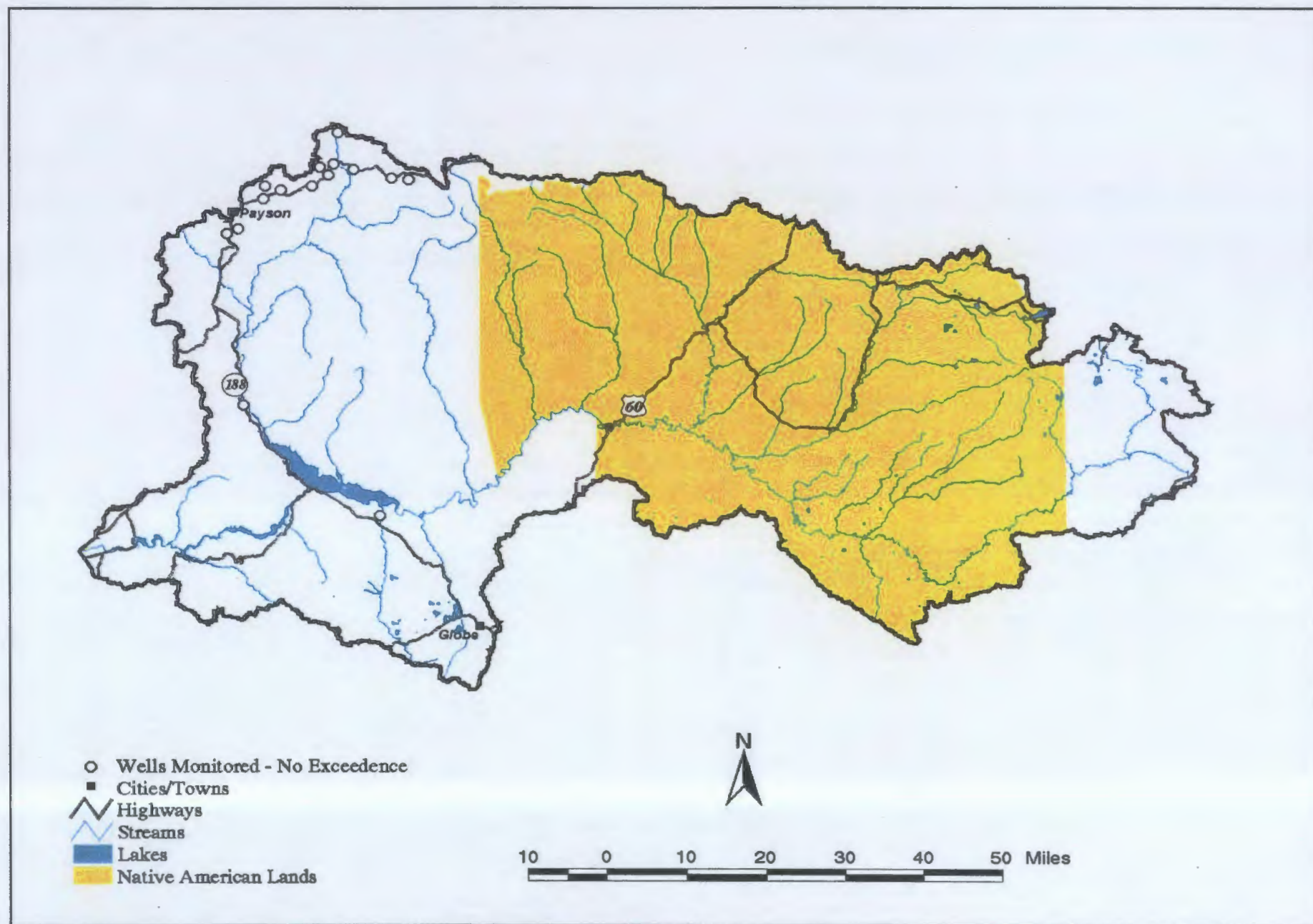


Figure 36. Ground Water Monitoring in the Salt Watershed – 1996-2000

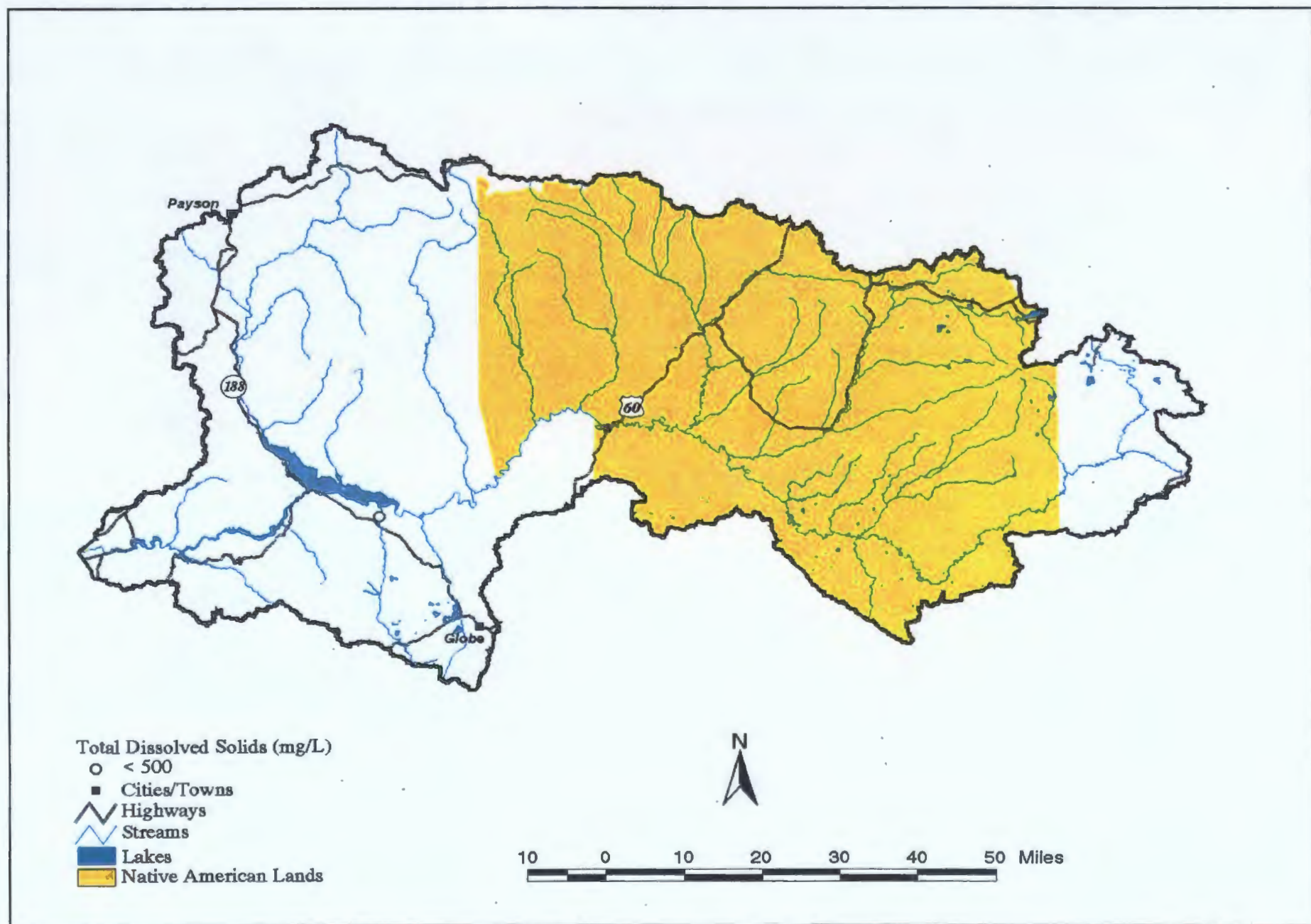


Figure 37. Classification of Ground Water Quality by TDS Concentration in the Salt Watershed

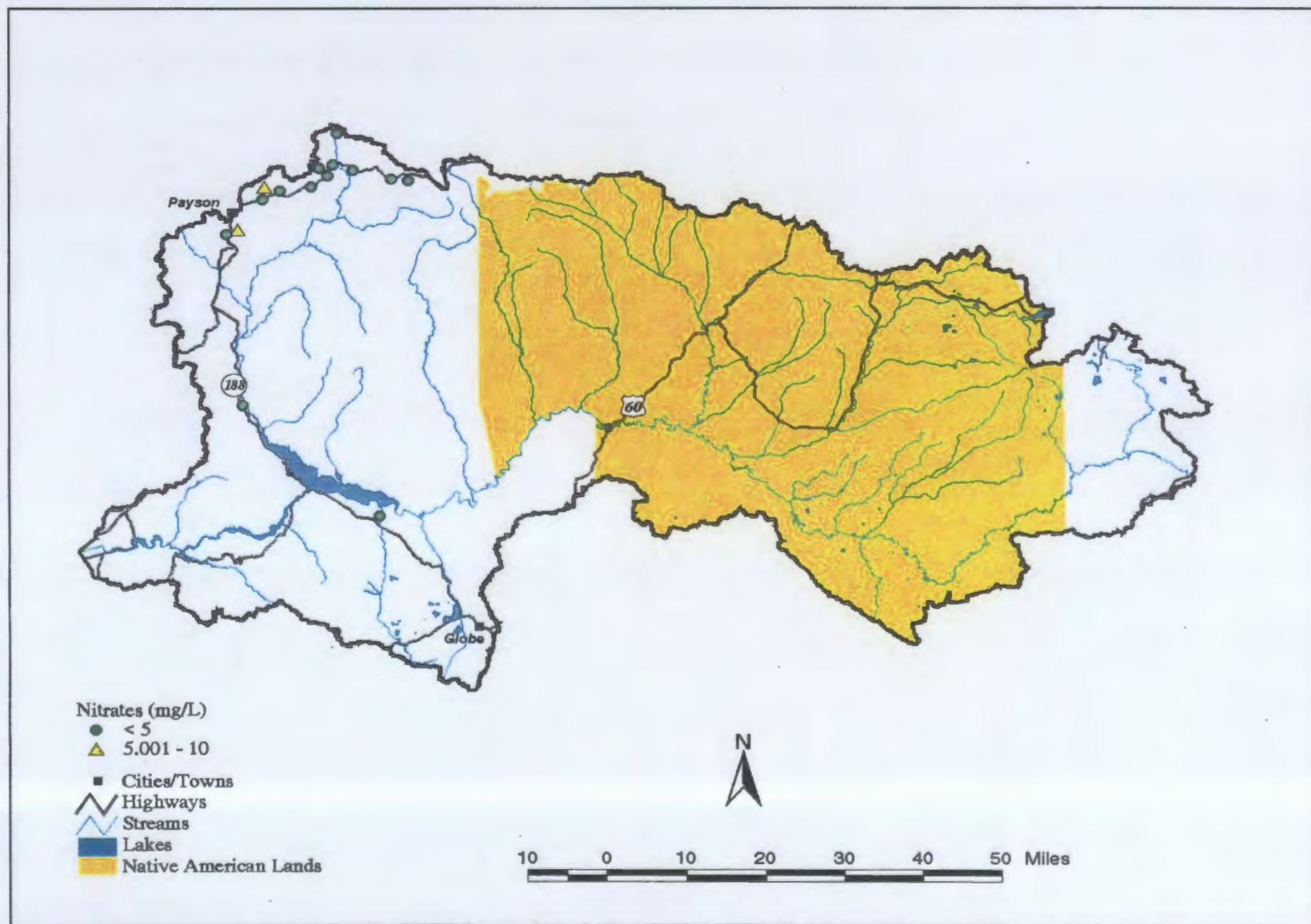


Figure 38. Classification of Ground Water Quality by Nitrate Concentration in the Salt Watershed

Watershed Studies and Alternative Solutions in the Salt Watershed

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Salt Watershed. Watershed partnerships active in this watershed are also described.

Surface Water Studies and Mitigation Projects

Total Maximum Daily Load Analyses – The following TMDL analyses have been completed or are ongoing in this watershed. Further information about the status of these investigations can be obtained by contacting the TMDL Program manager at (602) 771-4468, or at ADEQ's web site:

<http://www.adeq.state.az.us/envirom/water/assess/tmdl.html>

- ▶ The Pinto Creek Phase I Copper TMDL -- This TMDL was completed and approved by EPA in April 2001. ADEQ is currently involved in the sampling and analysis for a Phase II TMDL on this stream. This TMDL was established to define goals for the watershed necessary to achieve water quality criteria for dissolved copper. This water quality criterion varies with hardness in the water; the dissolved copper standard being more stringent with less water hardness.

The entire Pinto Creek, from its headwaters to Roosevelt Lake, was originally included on the 303(d) List as impaired by copper. Current monitoring and analysis indicates that Pinto Creek below the Pinto Valley Weir (or below Ripper Springs Creek) consistently meets all surface water standards and should be delisted.

Loading capacities were calculated for five stream flow events at nine target sites (locations), resulting in 45 different Total Maximum Daily Loads. At lowest flows (down to 0 cubic feet per second flow), the allocations are articulated on a concentration basis (mg/L) rather than a mass loading basis (mg/day). These concentration allocations are based on the standard that varies by water hardness.

A waste load allocation was established for the BHP Pinto Valley Mine outfall 005 and nonpoint source loading allocations were established for potential sources that contribute drainage to Pinto Creek at Miller

Spring Gulch, Gold Gulch, and North and South Ripper Spring canyons. These allocations were calculated based on the assumption that the proposed Carlotta Copper Mine will be developed along Pinto Creek. This assumption affected the allocations in two ways:

- ▶ Stream discharge values assumed proposed facilities were in place, and
- ▶ The Cactus Breccia Formation would no longer be a source of dissolved copper to Pinto Creek (due to mining and the Pinto Creek diversion).

Water quality management and remediation goals were set by this Phase I TMDL. EPA recognized that abandoned mines present significant technical, legal, and monetary challenges to designing and implementing remedial measures. Given the copper levels within Pinto Creek, and the potential to control one significant source of contamination (Gibson Mine, an abandoned mine), EPA believes that it is technically feasible to meet the proposed loading allocations.

To support the Pinto Creek Phase II Copper TMDL, ADEQ is collecting water quality data at 24 locations, monitoring continuous stream flow, and collecting precipitation data over a 12 to 18 month period. This data will be used to construct, calibrate and validate a dynamic point and non-point source model of the Pinto Creek watershed. The sample plan will attempt to further identify and quantify the source of copper from natural and from anthropogenic point and non-point sources, as well as monitor the effectiveness of any mitigation efforts implemented at the Gibson Mine.

- Tonto Creek TMDL Study – In 2000, ADEQ initiated monitoring to support phosphorus, nitrogen, and *Escherichia coli* TMDLs in a segment of Tonto Creek, from its headwaters to the Bear Flats residence area below Christopher Creek. Up to six nutrients, bacteria, and turbidity samples were collected at eleven sampling sites in 2000 to determine the extent of contamination and contribution from possible sources. Potential sources identified included: wildlife, recreation, septic tanks, and state fish hatchery.

Monitoring indicates that *Escherichia coli* should be delisted, as only two out of 41 samples exceeded this standard. ADEQ is also proposing to remove the nutrients on Tonto Creek from the 303(d) List as no single sample maximum nutrient standards were exceeded. More data is being collected (summer of 2002) to verify that the annual mean standards for nitrogen or phosphorus will not be exceeded.

Repeated exceedances of the turbidity standard during this monitoring indicates that turbidity is impairing Aquatic and Wildlife uses on this stream; therefore, this stressor should be added to the 303(d) List.

- Christopher Creek TMDL Study – ADEQ also initiated a TMDL for nitrogen on Christopher Creek in 2000. The study area included all of Christopher Creek, from its headwaters to its confluence with Tonto Creek. Eight sites were sampled up to six times in 2000 to determine the extent of contamination and contribution from possible sources of excess nitrogen. The potential sources of nitrogen were identified as: wildlife, recreation, and septic tanks.

The single sample maximum phosphorus and nitrogen standards were not exceeded in 39 samples. ADEQ is collecting (summer 2002) additional samples to verify that the annual mean nutrient standards are not being exceeded. Based on existing data, ADEQ is proposing to remove nutrients on Christopher Creek from the 303(d) List.

Sampling did indicate that turbidity is impairing Aquatic and Wildlife uses on this stream; therefore, this stressor should be added to the 303(d) List.

BHP NPDES Permit Monitoring in Pinto Creek – The BHP Pinto Valley Operations mine discharges into Pinto Creek. AMEC Earth and Environmental, Inc., a consultant for BHP, sampled six locations to fulfill requirement of the NPDES permit for the mine.

These samples were used in this assessment except for the data collected following a spill event (October 22, 1997 - July 31, 1998), as the cleanup of all contaminants from this spill has subsequently been completed.

Water Quality Improvement Grants – ADEQ awarded the following Water Quality Improvement Grants in this watershed.

- Lower Salt River Pollution Prevention Education and Outreach Project – The Tonto National Forest, Mesa Ranger District was funded in 2001 to install three restroom facilities along the Salt River below Saguaro Lake, conduct public education and outreach, and obtain bacterial water quality samples for two years. The project is to improve river water quality, by reducing bacteria levels due to intense recreational usage. The river has not been listed for impairments due to bacteria levels; however, previously restroom facilities were not available along a significant portion of this heavily used river.

This grant project is ongoing, with the first bacterial samples being collected in July of 2001 through September 2001. The second round of sampling will occur in the summer of 2002. For more information about the project, contact the Tonto National Forest, Mesa Ranger District at (480) 610-3312.

Water Protection Fund Projects – The following projects received Water Protection Funds from the Arizona Department of Water Resources:

- Lofer Cienega Restoration Project – The White Mountain Apache Tribe was funded to restore the large Lofer Cienega. This project incorporates stream assessments, long-term monitoring, fence construction, grazing management, biological assessments, and feral horse trapping and removal in an attempt to restore Lofer Cienega. When restored, this cienega should provide critical wildlife and fish habitat. In addition, it is a significant cultural resource to the tribe.
- Gooseberry “Watershed” Restoration Project – The White Mountain Apache Tribe was also awarded funds in 1999 to restore the Gooseberry drainage area by improving management of the riparian meadows and reconstructing stream crossings. The project incorporated stream assessments, improved riparian grazing management, cleanup projects and public education, channel restoration and biologic assessments to meet its goals.
- Cherry Creek Enhancement Demonstration Project – The Tonto National Forest received Watershed Protection Funds to restore one

degraded mile of Cherry Creek. The Forest Service is to assess the project site, including a topographic survey and evaluation of the site's characteristics and hydrology. The dimension, pattern, and profile of a selected reference channel will be used to guide the design of the restoration channel reconfiguration.

- Dakini Valley Riparian Project along Gordon Creek -- Dakini Valley LLC received funds to protect approximately one-half mile of Gordon Creek from overgrazing by constructing a two-mile long elk fence around the area. Cat claw, that has invaded two acres of Gordon Creek terrace, is to be cut down, the area reseeded with native grasses, and emory oak trees are to be planted along the stream bank. Two dirt tanks at Bear Flat are also to be repaired to provide off-channel water for cattle and elk. Informational signs and literature describing the project resource issues and goals are to be provided for visitors and guests at Dakini Valley.

Ground Water Studies and Mitigation Projects

Federal and State Superfund Cleanup Sites -- One Superfund site and one Department of Defense cleanup site are located in this watershed.

- Pinal Creek WQARF Superfund Site -- The Pinal Creek Group, an alliance of mining companies (BHP Copper, Inc, Inspiration Consolidated Copper Co., and Phelps Dodge Miami, Inc.), is performing cleanup activities at a WQARF superfund site located in the Pinal Creek sub-watershed near the Globe-Miami area. At this site metal-bearing acidic ground water is contaminating surface water in Pinal Creek.

Since 1987, the Pinal Creek Group has been pumping and treating ground water from a shallow and narrow aquifer underlying Bloody Tanks Wash and Pinal Creek. In November 1999, the Lower Pinal Creek Treatment Plant commenced operations to treat and then discharge treated water into the Pinal Creek surface flow. In May 2001, a second treatment plant and well field commenced operations to capture and treat groundwater in the Bloody Tanks Wash, the main tributary that previously fed contaminated ground water to Pinal Creek. As a result of the remedial activities at the mining sites and operation of treatment plants and well field containment systems, the metal

concentrations and the pH are now meeting Arizona surface water quality standards. The Pinal Creek Group will continue these remedial activities to ensure safe surface water quality under a federally approved Consent Decree between ADEQ and the Pinal Creek Group.

- Waterdog Recreational Annex Cleanup Site -- The Waterdog Recreation Area is a Department of Defense cleanup site located on the eastern shore of Apache Lake. This recreation area was originally an annex to Williams Air Force Base, constructed to provide access to Apache Lake for military and civilian air force personnel.

An inspection in 1991 of the three underground storage tanks used to fuel the boats revealed petroleum hydrocarbons were contaminating ground water and soils, and resulted in the removal of the storage tanks. Further remediation of the soils using a bioventing system began in 1995. Ground water samples from monitor wells in 1999 indicated petroleum contamination above the Arizona Aquifer Water Quality Standards. Quarterly ground water sampling will continue until the petroleum contamination is reduced to levels below these standards. The petroleum contamination is expected to be reduced due to both natural attenuation and on-going remediation activities.

Watershed Partnerships

The Lower Verde-Lower Salt Watershed Advisory Group -- This advisory group, formed 1999, is comprised of private citizens, U.S. Forest Service, ADEQ, Arizona Department of Water Resources, and Salt River Project. Key issues this group has focused on include:

- litter on lakes and rivers,
- potential for MTBE contamination in lakes,
- land use and traffic control,
- public education and outreach regarding environmental issues, and
- enforcement of existing environmental laws and regulations.

For information about meetings contact either Dan Jones, at the Maricopa County Sheriffs Office D_Jones@mcso.maricopa.gov and Lynda Bearult with Salt River Tubing Lynda@Saltrivertubing.com

San Pedro-Willcox Playa-Rio Yaqui Watershed



SAN PEDRO-WILLCOX PLAYA-RIO YAQUI WATERSHED CHARACTERISTICS

SIZE	7,015 square miles (6% of the State's land area).					
POPULATION BASE	Approximately 130,000 people live in this watershed (estimated from the 2000 census). This is about 2.5% of the state's population					
LAND OWNERSHIP (Figure 39)	Private land	38%	Bureau of Land Management	5%	Military land	4%
	State Land Dept.	38%	U.S. Forest Service	14%	Other state and federal	1%
LAND USES AND PERMITS (Figure 40)	<p>Communities in this watershed include rapidly growing Sierra Vista and historic landmarks such as Tombstone, Douglas, and Bisbee . Grazing is widespread in this watershed, with significant areas with irrigated agriculture along the eastern side. Historic copper, silver, and gold mining occurred across the watershed; however, there are only a few active mines and mining activity reflects current market values.</p> <p>The San Pedro Riparian National Conservation Area managed by the Bureau of Land Management was the nation's first such area. It received this designation in 1988 to protect a 56,000 acre area along the upper San Pedro River.</p>					
HYDROLOGY AND GEOLOGY	<p>Three hydrologically distinct surface water basins occur within this watershed: 1) The San Pedro River flows north from Mexico almost 100 miles to the Gila River, and contains many riparian areas that support rich wildlife populations; 2) The Willcox Playa is a terminal basin, so that all surface water drainage within this basin is ultimately collected in the playa; and 3) The Rio Yaqui basin contains Whitewater Draw and Black Draw with both drainages flowing south into Mexico. Flow on the San Pedro River at Charleston varies between 0.22 cfs (in 1990) to 98,000 (in 1926) (USGS 1996). Ground water pumping has limited the perennial flow of the San Pedro River flows to approximately 25 miles near the Mexican border (Brown et al. 1978).</p> <p>Diverse vegetation ranges from desert grassland at low elevations (4,000 feet above sea level) to alpine forest in the Pinaleno Mountains, which rise to 10,700 feet above sea level at Mount Graham. The geology is characterized by mountain ranges that trend to the northwest, separated by broad alluvial valleys and three kinds of aquifers. This is typical of the Basin and Range Hydrologic Province that this watershed is included within.</p> <p>Several ground water basins occur in this watershed, including: Aravaipa Canyon, Douglas, San Bernadino Valley, Upper San Pedro, Willcox Playa, most of the Lower San Pedro, and a small portion of Cienega Creek. The consolidated bedrock of the mountains that divide the ground water basins has small localized aquifers (created by fault zones). They provide only enough water for low-use domestic and stock wells. The main ground water source is provided by alluvial basin-fill sediments. Wells in these aquifers can produce more than 2,000 gallons per minute. Also, streambed alluvial aquifers produce well yields up to 1,800 gallons per minute (ADWR 1994).</p>					
UNIQUE WATERS	Aravaipa Canyon Creek and Buehman Canyon Creek					
ECOREGIONS	Southern Deserts, except the northern edge that is in the Southern Basin and Range.					
OTHER STATES, NATIONS, OR TRIBES	<p>This watershed primarily receives drainage from Mexico on the south and New Mexico on the east. However, the drainage from Whitewater Draw and Black Draw flows into Mexico. No tribal lands occur in this watershed.</p>					

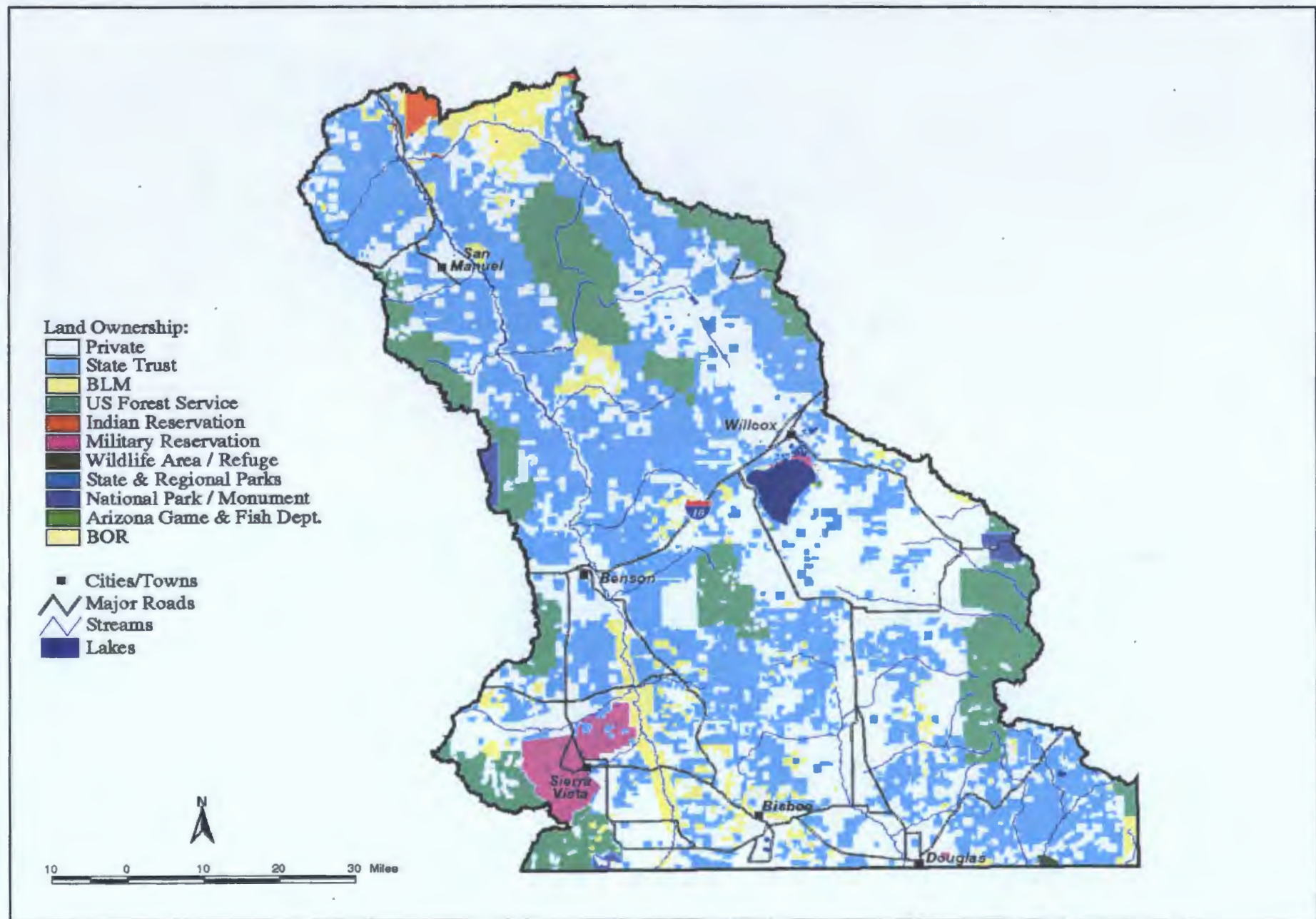


Figure 39. Land Ownership in the San Pedro-Willcox Playa-Rio Yaqui Watershed

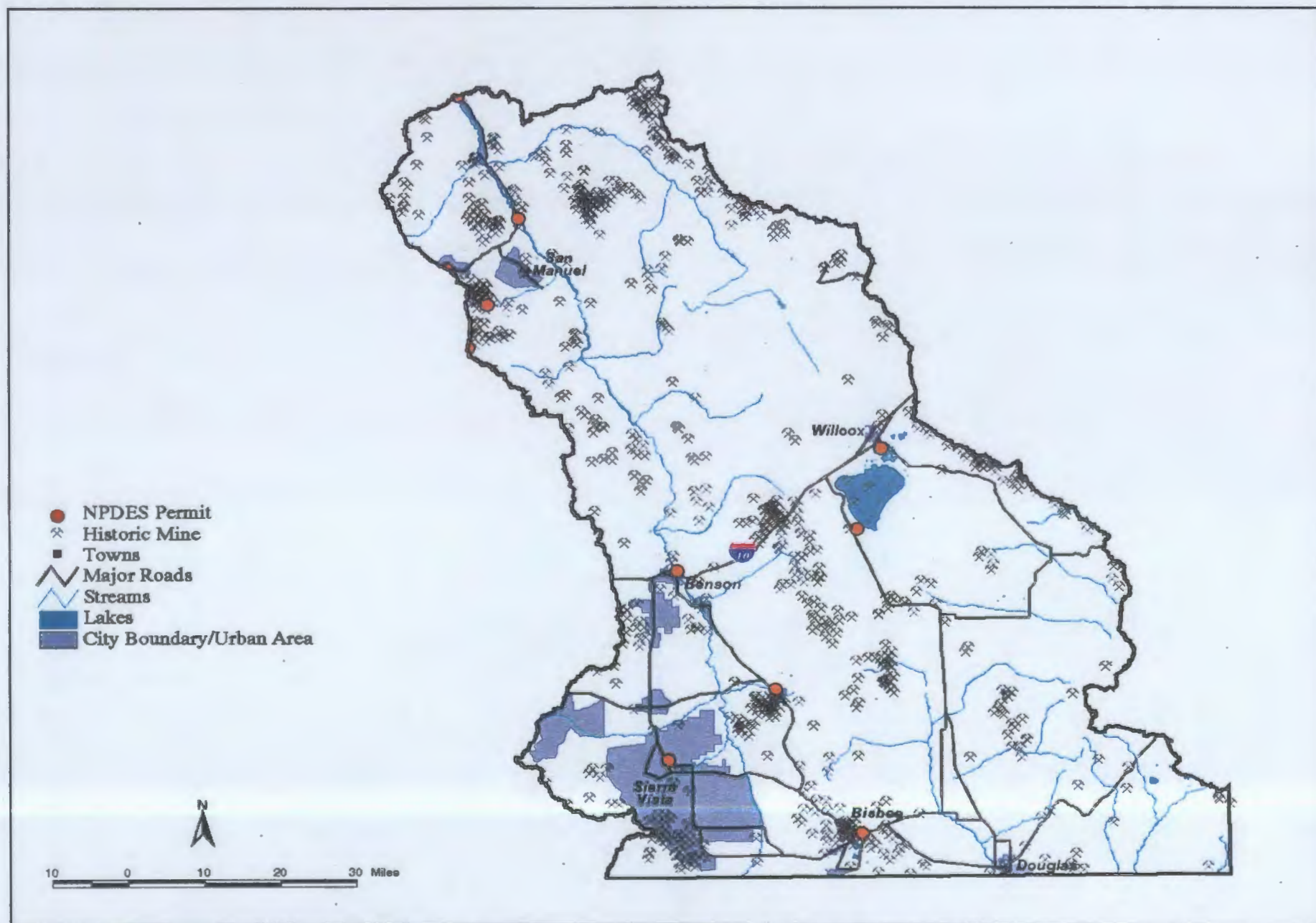


Figure 40. General Land Use and NPDES Permits in the San Pedro-Willcox Playa-Rio Yaqui Watershed

San Pedro-Willcox Playa-Rio Yaqui Watershed Assessment Discussion

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 244 miles of streams or washes and 10 acres of lakes were assessed. This assessment includes the water quality monitoring data collected in 2000 when this was one of two focus watersheds.

Water quality assessment information for the San Pedro-Willcox Playa-Rio Yaqui Watershed is summarized in the following tables and illustrated on Figure 41.

Table 21. Assessments in the San Pedro-Willcox Playa-Rio Yaqui Watershed – 2002

	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	200	15	0	0
INCONCLUSIVE	14	3	10	2
IMPAIRED	30	5	0	0
NOT ATTAINING	0	0	0	0
TOTAL ASSESSED	244	23	10	2

PERENNIAL SURFACE WATERS ASSESSED		STREAMS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	206	14	10	2

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial mileage although part of the reach may have ephemeral or intermittent flow.

Inconclusive Assessments – Surface waters with some monitoring data, but insufficient data to determine if a designated use is attaining or impaired, were added to the new Planning List. By the end of the next watershed monitoring cycle (scheduled in 2005), ADEQ expects to monitor most of the surface waters

on the Planning List so that all designated uses can be assessed during the following assessment cycle. Other lakes and streams which lack water quality monitoring data will also be monitored depending on resources and priorities.

ADEQ will be working with US Geological Survey and other state and federal agencies to collected monitoring data, so that their future monitoring efforts will better support Arizona's surface water assessments.

Major Stressors – When a surface water is listed as impaired or not attaining a designated use, the pollutants or suspected pollutants causing the impairment are indicated. Impaired reaches can be divided into two problems:

- ▶ High nitrate levels seeping into the San Pedro River due to ground water contamination at the Apache Powder Superfund cleanup site; and
- ▶ Historic mining activities in the Bisbee, Arizona area that has lead to copper, zinc and low pH contamination of Mule Gulch and its tributaries.

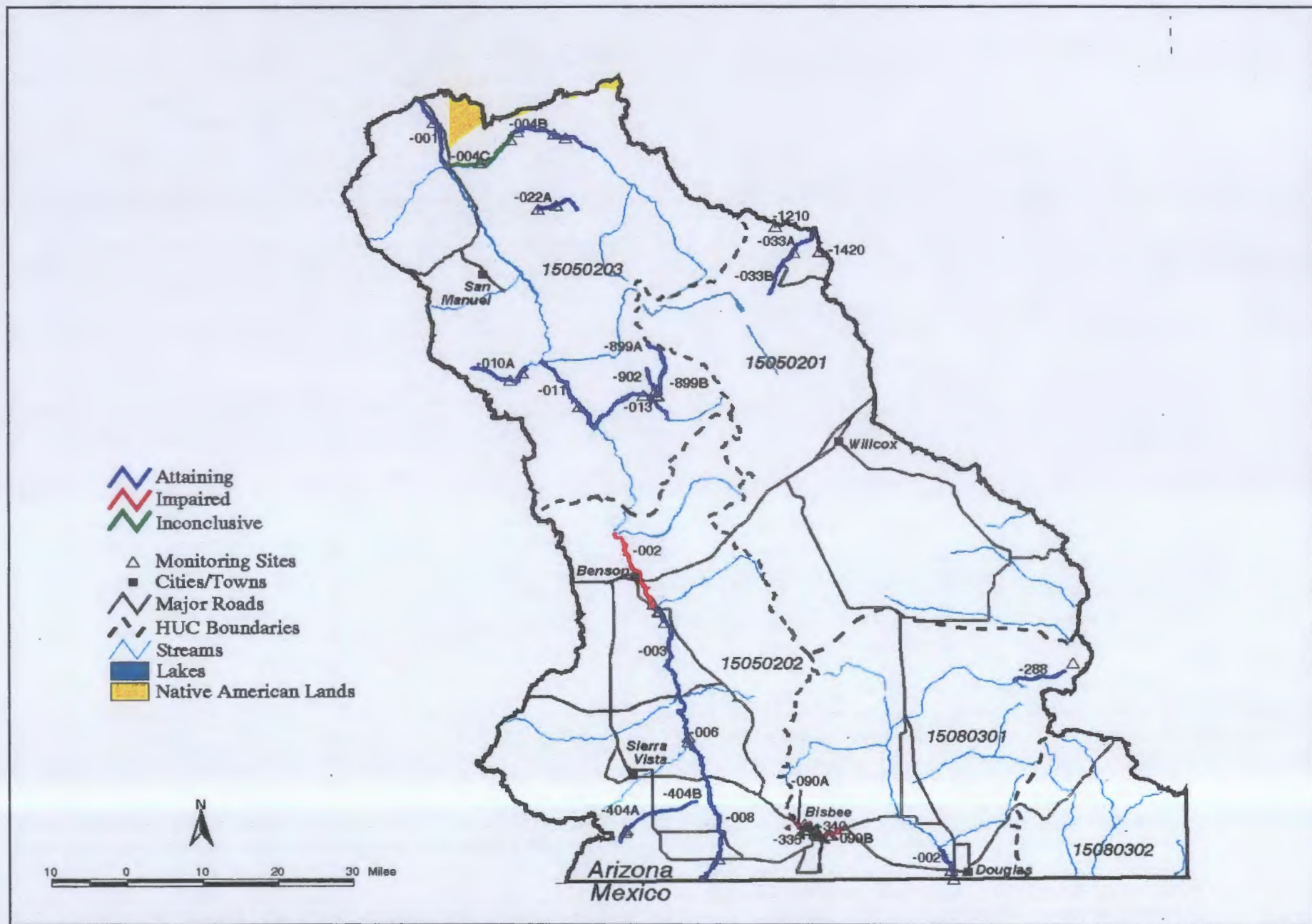


Figure 41. San Pedro-Willcox Playa-Rio Yaqui Watershed 2002 Assessments

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Aravaipa Canyon Creek headwaters-Stowe Gulch AZ15050203-004A A&Ww, FC, FBC, DWS, AgL	ADEQ Stream Ecosystem Monitoring Near springs SPARA012.45 100209	1998 - 1 suite	OK					
	Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient data to assess.
Aravaipa Canyon Creek Stowe Gulch-Wilderness AZ15050203-004B A&Ww, FC, FBC, DWS, AgL	ADEQ Ambient and Bioassessment At Hells Half Acre (West end) SPARA007.92 100716	1997 - 1 suite(no bacterial samples) 2000 - 4 suites	OK					
	ADEQ Ambient and Bioassessment Below Parson's Canyon SPARA010.40 100211	1997 - 1 suite (no bacterial samples) 1998 - 1 suite (no bacterial samples) 2000 - 4 suites	OK					
	ADEQ Stream Ecosystem Monitoring At east trail head SPARA011.03 100210	1998 - 1 suite 2000 - 1 suite (no bacterial samples)	OK					
	Summary Row A&Ww Attaining FC Attaining FBC Attaining DWS Attaining AgL Attaining	1997 - 2000 13 samples 6 sampling events	OK				Attaining	ADEQ collected a total of 13 samples at 3 sites in 1997 - 2000. Reach assessed as "attaining all uses."
Aravaipa Canyon Creek Wilderness Area-San Pedro AZ15050203-004C A&Ww, FC, FBC, DWS, AgL	ADEQ Ecosystem Monitoring 5 miles from terminus SPARA002.96 100213	1998 - 1 suite	OK					Missing core parameters: bacteria.
	ADEQ Ecosystem Monitoring At Woods Ranch SPARA006.75 100212	1998 - 1 suite 2000 - 1 suite	OK					Missing core parameters: bacteria.
	Summary Row A&Ww Inconclusive FC Inconclusive FBC Inconclusive DWS Inconclusive AgL Inconclusive	1997 - 2000 3 samples 2 sampling events Missing a core parameter	OK				Attaining	ADEQ collected a total of 3 samples at 2 sites from 1998 - 2000. Reach assessed as "Inconclusive" and added to the Planning List due to lack of sampling events and missing bacteria samples.

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Bass Canyon Creek headwaters-Hotsprings AZ15050203-899 A&Ww, FC, FBC	ADEQ Stream Ecosystem Monitoring Above Hot Springs Cyn Creek SPBAS000.24 100217	1998 - 1 suite	OK					Missing core parameters: bacteria
	ADEQ Fixed Station Network Above Double R Canyon SPBAS000.75 100215	2000 - 5 suites	OK					
	ADEQ Stream Ecosystem Monitoring At stream length 9.2 miles SPBAS001.54 100214	1998 - 1 suite	OK					Missing core parameters: bacteria
	Summary Row A&Ww Attaining FC Attaining FBC Attaining	1998 - 2000 7 samples 6 sampling events	OK				Attaining	ADEQ collected a total of 7 samples at 3 sites from 1998 - 2000. Reach assessed as "attaining all uses."
Unnamed trib. to Bass Canyon headwaters - Bass Canyon Cr. AZ15050203-935 A&Ww, FBC, FC	ADEQ Stream Ecosystem Monitoring Unnamed-east of Bass Canyon Creek SPUBS000.20 100224	1998 - 1 suite	OK					Missing core parameters: mercury and bacteria.
	Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient sampling events to assess.
Brewery Gulch Wildcat Canyon-Mule Gulch AZ15080301-337 A&We, PBC	ADEQ TMDL Program Above mineralized zone RMBRG000.90	2000 - 1 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	9 (A&We)	26	1 of 1		
	ADEQ TMDL Program At Mule Gulch RMBRG000.01	2000 - 4 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	Varies (A&We)	52 - 150	4 of 4		
	Summary Row A&We Impaired PBC Inconclusive	2000 5 samples 4 sampling events Missing core parameters	Copper (dissolved) µg/l	Varies (A&We)	26 - 150	5 of 5	Impaired	ADEQ collected a total of 5 samples at two sites in 2000. Reach assessed as impaired due to copper.

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Buehman Canyon headwaters-end Unique Waters AZ15050203-010A A&Ww, FC, FBC, AgL Unique Waters	ADEQ Ambient Monitoring 2 miles below Bullock Canyon SPBHC002.46 100425	1996 - 1 suite 2000 - 4 suites	Dissolved oxygen mg/L	6.0 (90% saturation) A&Ww	2.38-8.26 (31- 98% saturation)	3 of 5		Naturally occurring low dissolved oxygen due to very low stream flow (less than 1 cfs) and ground water upwelling. Not included as exceedance in final assessment.
	ADEQ Fixed Station Network Above USFS Road 801 SPBHC003.90 100272	1996 - 5 suites 1997 - 4 suites (no bacterial samples)	Beryllium (total) µg/l	0.21 FC	1.3-2.0	8 of 8		Two other beryllium samples were not used because the Laboratory Reporting Limit was too high
			Dissolved oxygen mg/l	6.0 (90% saturation) A&Ww	5.42-7.78 (57- 91% sat)	2 of 6		Naturally occurring low dissolved oxygen due to ground water up-welling. Exceedances not included in final assessment.
	Summary Row A&Ww Attaining FC Inconclusive FBC Attaining AgL Attaining	1996 - 2000 14 sampling events	Beryllium (total) µg/l	0.21 FC	1.3-2.0	8 of 8	Inconclusive	ADEQ collected a total of 14 samples at two sites from 1996 - 2000. Reach assessed as "attaining some uses" and added to the Planning List due to beryllium exceedances.
C - Canyon headwaters- Mule Gulch AZ15080301-342 A&We, PBC	ADEQ TMDL Program At Highway 80 RMCCN000.01	2000 - 1 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	47 (A&We)	55	1 of 1		
	Summary Row	2000 1 sampling event	Copper (dissolved) µg/l	47 (A&We)	55	1 of 1	Not assessed	Insufficient sampling events and parametric coverage to assess. Add to Planning List due to copper exceedance.
Copper Creek headwaters-Prospect Canyon AZ15050203-022A A&Ww, FC, FBC, AgL	ADEQ Ambient Monitoring Above Bluebird Mine drainage SPCOP007.09 100433	1996 - 1 suite (no bacteria) 2000 - 3 suites	OK					
	ADEQ Fixed Station Network Below Dark Canyon SPCOP005.80 100944	2000 - 4 suites	Dissolved oxygen mg/L	6.0 (90% saturation) A&Ww	5.95 - 9.91 (84% - 101% saturation)	1 of 4		Exceedance within equipment tolerance interval of +/- 0.2 mg/L. Exceedance not included in final assessment.
	Summary Row A&Ww Attaining FC Attaining FBC Attaining DWS Attaining AgL Attaining	1996 - 2000 8 sampling events	OK				Attaining	ADEQ collected a total of 8 samples at two sites from 1996 - 2000. Reach assessed as "attaining all uses."
Double R Canyon Creek headwaters-Bass Cyn Creek AZ15050203-902 A&Ww, FC, FBC, AgL	ADEQ Stream Ecosystem Near Terminus SPDOU000.20 100223	1998 - 1 suite 2000 - 1 suite	Dissolved oxygen mg/l	6.0 (90% saturation) A&Ww	4.67 - 6.2 (59 - 70% saturation)	1 of 2		Missing core parameters: bacteria
	ADEQ Ambient Monitoring At stream length 4.2 miles SPDOU001.00 100222	1998 - 1 suite	Dissolved oxygen mg/l	6.0 (90% saturation) A&Ww	5.72 (61% saturation)	1 of 1		Missing core parameters: bacteria

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Ww Inconclusive FC Attaining FBC Inconclusive DWS Attaining AgL Attaining	1998 - 2000 3 sampling events Missing core parameters	Dissolved oxygen mg/l	6.0 (90% saturation) A&Ww	4.87 - 6.2 (59 - 70% saturation)	2 of 3	Inconclusive	ADEQ collected a total of 3 samples at two sites from 1998 - 2000. Reach assessed as "attaining some uses" and added to Planning List due to low dissolve oxygen test results and missing bacteria samples.
Dubacher Canyon headwaters to Mule Gulch AZ15080301-075 A&We, PBC	ADEQ TMDL Program Below Highway 80 RMDBC000.01	2000 - 2 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	Varies (A&We)	36,000 - 78,000	2 of 2		
			pH(low) SU	6.5-9.0 (A&We, PBC)	2.3	1 of 1		
	Summary Row A&We Impaired PBC Inconclusive	2000 2 sampling events Missing core parameters	Copper (dissolved) µg/l	Varies (A&We)	36,000-78,000	2 of 2	Impaired	ADEQ collected a total of 2 samples at one site in 2000. Reach assessed as "Impaired" due to copper and zinc. Also added to the Planning List due to low pH reading and missing core parameters.
			pH (low) SU	6.5-9.0 (A&We, PBC)	2.3	1 of 1	Inconclusive	
Grant Creek headwaters-High Creek AZ15050201-033 A&Wc, FC, FBC, DWS, AgL	ADEQ Ambient Monitoring 1 mile below Post Creek WPGRA006.56 100561	1997 - 1 suite(no bacteria, fluoride) 2000 - 2 suites	OK					
	Summary Row A&Wc Attaining FC Attaining FBC Inconclusive DWS Inconclusive AgL Attaining	1997 - 2000 3 sampling events Missing core parameters	OK				Attaining	ADEQ collected 3 samples from 1997 - 2000. Reach assessed as "attaining some uses" and added to the Planning List due to missing core parameters.
Hendricks Gulch headwaters to Mule Gulch AZ15080301-335 A&We, PBC	ADEQ TMDL Program At confluence with Mule Gulch RMHNG000.01	2000 - 3 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	Varies (A&We)	15 - 76	1 of 3		
			pH (low) SU	6.5-9.0 (A&We, PBC)	5.75 - 7.39	1 of 2		
	Summary Row A&We Inconclusive PBC Inconclusive	2000 3 sampling events Missing core parameters	Copper (dissolved) µg/l	Varies (A&We)	15 - 76	1 of 3	Inconclusive	ADEQ collected 3 samples in 2000. Reach assessed as "Inconclusive" due to insufficient samples and core parameters.
			pH (low) SU	6.5-9.0 (A&We, PBC)	5.75 - 7.39	1 of 2	Inconclusive	
Hot Springs Canyon Creek headwaters-San Pedro AZ15050203-013 A&Ww, FC, FBC, AgL	ADEQ Stream Ecosystem Monitoring Southwest of Wildcat Peak SPHSC006.04 100220	1998 - 1 suite	OK					Missing core parameters: bacteria

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	ADEQ Ambient and Bioassessment Below Wildcat Canyon SPHSC006.13 100574	1997 - 1 suite (no bacterial samples) 2000 - 5 suites	OK					
	ADEQ Stream Ecosystem Monitoring Below Bass Canyon Creek SPHSC006.22 100219	1998 - 1 suite	OK					Missing core parameters: bacteria
	Summary Row A&Ww Attaining FC Attaining FBC Attaining AgL Attaining	1997 - 2000 8 samples	OK				Attaining	ADEQ collected a total of 8 samples at 3 sites in 1997-2000. Reach assessed as "attaining all uses."
Morales Creek headwaters-Mule Gulch AZ15080301-331 A&We, PBC	ADEQ TMDL Program Lat 31°27'07.1" Long 109°56'26.9" RMMOR000.40	2000 - 1 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	11 (A&We)	18	1 of 1		
	Summary Row	2000 1 sample	Copper (dissolved) µg/l	11 (A&We)	18	1 of 1	Not assessed	Insufficient sampling events to assess. Add to Planning List due to copper.
Miller Canyon Creek headwaters-San Pedro AZ15050202-409 A&Wc, FC, FBC, DWS, AgL	ADEQ Bioassessment Program Near headwaters SPMLC008.64 100592	1998 - 1 suite (no bacteria, total mercury, dissolved chromium/zinc)	OK					
	Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient sampling events and parametric coverage to assess.
Mule Gulch headwaters-WWTP AZ15080301-090A A&Ww, FC, PBC, AgL, AgL	ADEQ TMDL Program Above C-Canyon RMMLG005.10	1999 - 1 pH, copper, zinc	Copper (dissolved) µg/l	Varies (64) (A&Ww)	1,200	1 of 1		
			Zinc (dissolved) µg/l	Varies (371) (A&Ww)	2,400	1 of 1		
			pH (low) SU	6.5-9.0 (A&Ww, PBC, AgL, AgL)	3.24	1 of 1		
	ADEQ TMDL Program At traffic circle RMMLG005.26 100507	1998 - 3 pH, copper, zinc	Copper (dissolved) µg/l	Varies (A&Ww)	2,356-10,050	3 of 3		
			Copper (total) µg/l	500 (AgL)	1,762-10,500	3 of 3		

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
			Zinc (dissolved) µg/l	Varies (A&Ww)	2,040-3,760	3 of 3		
			pH (low) SU	6.5-9.0 (A&Ww, PBC, Agl, AgL)	3.4-5.5	3 of 3		
	ADEQ TMDL Program Above mill site RMMLG005.28	1999 - 1 pH, copper, zinc	Copper (dissolved) up/l	Varies (39) (A&Ww)	4,200	1 of 1		
			Zinc (dissolved) µg/l	Varies (237) (A&Ww)	240	1 of 1		
			pH (low) SU	6.5-9.0 (A&Ww, PBC, Agl, AgL)	3.07	1 of 1		
	ADEQ TMDL Program At Castle Rock (MG-2) RMMLG005.94 100506	1998 - 4 pH, copper, zinc	OK					
	ADEQ TMDL Program Below old mill site RMMLG011.25	2000 - 2 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) up/l	Varies (A&Ww)	4000	2 of 2		
			Zinc (dissolved) µg/l	Varies (237) (A&Ww)	240 - 430	2 of 2		
			pH (low) SU	6.5-9.0 (A&Ww, PBC, Agl, AgL)	3.0	1 of 1		
	ADEQ TMDL Program At Lavender Pit RMMLG012.11	2000 - 5 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	Varies (A&Ww)	11 - 110	5 of 5		
			pH (low) SU	6.5-9.0 (A&Ww, PBC)	5.78 - 8.94	1 of 5		
	Summary Row A&Ww Impaired PC Inconclusive PBC Inconclusive Agl Inconclusive AgL Inconclusive	1998 - 1999	Copper (dissolved) µg/l	Varies (A&Ww)	1,200 - 10,050	12 of 16	Impaired	ADEQ collected a total of 9 samples at four sites in 1998-1999. Reach assessed as Impaired due to copper and zinc. Reach also added to the Planning List due to low pH and missing core parameters.
		9 samples	Copper (total) µg/l	500 (Agl)	1,762 - 10,500	5 of 16	Inconclusive	
		Missing core parameters	Zinc (dissolved) µg/l	Varies (A&Ww)	240 - 3,760	7 of 16	Impaired	
			pH (low) SU	6.5-9.0 (A&Ww, PBC, Agl, AgL)	3.00 - 5.5	7 of 15	Inconclusive	

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
Mule Gulch WWTP-Whitewater Draw AZ15080301-090B A&Wedw, PBC, AgL	ADEQ TMDL Program At Elfrida cutoff RMMLG002.75 100225	1998 - 2 pH, copper, zinc	Copper (dissolved) µg/l	Varies (45-48) A&Wedw	76-118	2 of 2		
	ADEQ TMDL Program Below unnamed wash RMMLG004.22 100509	1998 - 3 pH, copper, zinc	Copper (dissolved) µg/l	Varies (33-39) (A&Wedw)	43-85	3 of 3		
	ADEQ TMDL Program Below WWTP RMMLG004.50 100508	1998 - 4 pH, copper, zinc	OK					
	ADEQ TMDL Program At MG-300 (a.k.a. FSN MG-1) RMMLG007.12	1999 - 1 pH, copper, zinc 2000 - 4 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) up/l	Varies (A&Wedw)	62 - 12,000	3 of 5		
			Zinc (dissolved) µg/l	Varies (A&Wedw)	50 - 1,900	2 of 5		
			pH (low) SU	6.5-9.0 (A&Wedw, PBC, AgL)	3.16 - 8.58	2 of 5		
	ADEQ TMDL Program At MG-200 (old site) RMMLG009.26	1999 - 1 pH, copper, zinc 2000 - 1 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) up/l	Varies (A&Wedw)	10 - 7,300	1 of 2		
			Zinc (dissolved) µg/l	Varies (A&Wedw)	50 - 2,600	1 of 2		
			pH (low) SU	6.5-9.0 (A&Wedw, PBC, AgL)	4.15 - 8.08	2 of 2		
	ADEQ TMDL Program At MG-200 (new site) RMMLG009.28	2000 - 4 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) up/l	Varies (A&Wedw)	110 - 10,000	4 of 4		
			Zinc (dissolved) µg/l	Varies (A&Wedw)	110 - 2,600	4 of 4		
			pH (low) SU	6.5-9.0 (A&Wedw, PBC, AgL)	3.09 - 7.90	3 of 4		
	Summary Row A&Wedw Impaired PBC Impaired AgL Impaired	1998-2000 20 samples 4 sampling events Missing core parameters	Copper (dissolved) µg/l	Varies (A&Wedw)	10 - 12,000	8 of 20	Impaired	ADEQ collected a total of 20 samples at six sites from 1998-2000. Reach assessed as "Impaired" due to copper, zinc, and low pH.
			pH (low) SU	6.5-9.0 (A&Wedw, PBC, AgL)	3.09 - 8.08	7 of 20	Impaired	
			Zinc (dissolved) µg/l	Varies (A&Wedw)	50 - 2,600	7 of 20	Impaired	

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Mural & Grassy Hill Tributary headwaters to Mule Gulch AZ15080301-344 A&We, PBC	ADEQ TMDL Program At Mule Gulch RMMHC000.01	2000 - 1 DO, pH, cadmium, copper, lead, zinc	Copper (dissolved) µg/l	8 (A&We)	15	1 of 1		
	Summary Row	2000 1 sample	Copper (dissolved) µg/l	8 (A&We)	15	1 of 1	Not assessed	Insufficient sampling events and parametric coverage to assess.
Paige Creek headwaters-San Pedro AZ15050203-823 A&Ww, FC, FBC, Agl, AgL	ADEQ Biocriteria program Below Hells Gate SPPAI007.50 100616	1996 - 1 suite	OK					
	Summary Row	1996 1 sampling event	OK				Not assessed	Insufficient sampling events to assess.
Ramsey Canyon Creek headwaters-San Pedro AZ15050202-404 A&Wc, FC, FBC, DWS, Agl, AgL	ADEQ Ambient and Bioassessment Above Nature Conservancy SPRMC007.43 100625	1998 - 1 suite(no bacterial samples) 2000 - 2 suites	OK					
	ADEQ Fixed Station Network SPRMC007.18 101060	2000 - 2 suites	OK					
	Summary Row A&Wc Attaining FC Attaining FBC Attaining DWS Attaining Agl Attaining AgL Attaining	1998 - 2000 5 sampling events	OK				Attaining	ADEQ collected a total of 5 samples at 2 sites in 1998 - 2000. Reach assessed as "attaining all uses."
Redfield Canyon headwaters-San Pedro River AZ15050203-014 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program Below Sycamore Canyon SPRDC006.89	1997 - 1 suite (no bacteria or boron)	OK					No bacterial or boron samples included in parametric coverage.
	Summary Row	1997 1 sampling event	OK				Not assessed	Insufficient sampling events to assess.
Rucker Canyon Creek headwaters- Whitewater Draw AZ15080301-288 A&Wc, FC, FBC, DWS, AgL	ADEQ Fixed Station Network Above upper-most campsite RMRUC005.63 100938	2000 - 4 suites	Dissolved oxygen mg/L	7 (90% saturation) (A&Wc)	6.38 - 7.88 (77 - 95% saturation)	1 of 4		Naturally low dissolved oxygen during low flow (less than 1 cfs); therefore, not included as exceedence in final assessment.

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row A&Wc Attaining FC Attaining FBC Attaining DWS Attaining AgL Attaining	2000 4 samples	OK				Attaining	ADEQ collected 4 samples in 2000. Reach assessed as "attaining all uses."
San Pedro River Mexico border-Charleston AZ15050202-008 A&Ww, FC, FBC, Agl, AgL	USGS Station #09471000 At CharlestonSPSPR096.49 100747	1996 - 9 suites 1997 - 13 suites 1998 - 12 suites 1999 - 8 suites 2000 - 10 suites	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	5.6-9.9	5 of 52		Missing core parameters: turbidity, and only beryllium analyses performed.
	ADEQ Stream Ecosystem Monitoring At Charleston Road SPSPR096.49 100291	2000 - 1 suite	OK					
	ADEQ Fixed Station Network Near Palominas SPSPR113.55 100275	1996 - 4 suites 1997 - 3 suites 1998 - 4 suites 1999 - 3 suites 2000 - 3 suites	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	5.58-10.1 (79% - 110% saturation)	1 of 15		Naturally low dissolved oxygen during low flow (less than 1 cfs); therefore, not included as exceedance in final assessment.
			Beryllium µg/l	0.21 (FC)	0.61	1/1		15 other beryllium samples were not counted because the Laboratory Reporting Limit was too high.
			Turbidity NTU	50 (A&Ww)	0.89 - 460	2 of 17		
	Summary Row A&Ww Attaining FC Inconclusive FBC Attaining Agl Attaining AgL Attaining	1996 - 2000 70 sampling events	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	5.58-10.1 (79% - 110% saturation)	6 of 68	Attaining	ADEQ and USGS collected a total of 70 samples at two sites in 1996 - 2000. Reach assessed as "attaining some uses." Add to Planning List due to beryllium exceedance.
			Beryllium µg/l	0.21 (FC)	0.61	1 of 1	Inconclusive	
			Turbidity NTU	50 (A&Ww)	0.89 - 460	2 of 18	Attaining	
San Pedro River Charleston-Walnut Gulch AZ15050202-006 A&Ww, FC, FBC, Agl, AgL	ADEQ Fixed Station Network Below Graveyard Gulch SPSPR095.71 100653	2000 - 4 suites	Turbidity NTU	50 (A&Ww)	1.41 - 258	1 of 4		
	Summary Row A&Ww Inconclusive FC Attaining FBC Attaining Agl Attaining AgL Attaining	2000 4 sampling events	Turbidity NTU	50 (A&Ww)	1.41 - 258	1 of 4	Inconclusive	ADEQ collected 4 samples at one site in 2000. Reach assessed as "attaining some uses" and added to the Planning List due to turbidity exceedance.

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
San Pedro River Babocomari - Dragoon Wash AZ15050202-003 A&Ww, FC, FBC, Agl, AgL	ADEQ Fixed Station Network 0.8 miles south of Hwy 80 SPSPR077.66 100281	2000 - 4 suites	<i>Escherichia coli</i> CFU/100 ml	580 (FBC)	39 - 660	1 of 4		
	Hargis & Assoc. CERCLA Monitoring Below Apache Nitrogen Prod. SPSPR079.71	1998 - 4 suites 1999 - 3 suites 2000 - 3 suites	OK					Missing core parameters: flow, DO, turbidity, pH, nitrogen, phosphorus, metals, E. coli, and boron.
	Summary Row A&Ww Attaining FC Attaining FBC Inconclusive Agl Attaining AgL Attaining	1998 - 2000 14 sampling events	<i>Escherichia coli</i> CFU/100 ml	580 (single sample maximum) FBC	39-660	1 of 4	Inconclusive	ADEQ collected 4 samples and Hargis & Associates collected 10 samples at separate sites in 1998 - 2000. Reach assessed as "attaining some uses" and added to the Planning List due to bacteria exceedance.
San Pedro River Dragoon Wash-Tres Alamos AZ15050202-002 A&Ww, FC, FBC, Agl, AgL	Hargis & Assoc. CERCLA Monitoring Above Apache Nitrogen Products SPSPR076.35	1996 - 4 suites 1997 - 4 suites 1998 - 4 suites 1999 - 2 suites 2000 - 3 suites	OK					Missing core parameters: flow, DO, turbidity, pH, nitrogen, phosphorus, metals, E. coli, and boron.
	Hargis & Assoc. CERCLA Monitoring Mid Apache Nitrogen Products SPSPR077.31	1996 - 4 suites 1997 - 4 suites 1998 - 4 suites 1999 - 3 suites 2000 - 4 suites	Nitrate (as nitrogen) mg/l	10 (A&Ww)	0.43-22.6	5 of 20		Missing core parameters: flow, DO, turbidity, pH, nitrogen, phosphorus, metals, E. coli, and boron.
	Summary Row A&Ww Impaired FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	1996 - 2000 36 samples 19 sampling events Missing core parameters	Nitrate (as N) mg/l	10 (A&Ww)	0.43-22.6	5 of 20	Impaired	Hargis and Associates collected a total of 36 samples at two sites in 1996 - 2000. Reach assessed as "Impaired" due to nitrate and was added to the Planning List due to missing core parameters.
San Pedro River Hot Springs Cr.-Redfield Cyn. AZ15050203-011 A&Ww, FC, FBC, Agl, AgL	ADEQ Ambient Monitoring Program Near Cascabel SPSPR046.96 100289	2000 - 5 suites	Dissolved oxygen mg/L	6.0 (90% saturation) (A&Ww)	5.59 - 9.81 (63 - 93% saturation)	2 of 5		Naturally low dissolved oxygen due to ground water up-welling. Exceedance not included in final assessment.
			<i>Escherichia coli</i> CFU/100 ml	580 (FBC)	4 - 16,000	1 of 4		Flood conditions present.
			Fecal Coliform CFU/100 ml	4000 (A&Ww, AgL, Agl)	5 - 6000	1 of 4		Flood conditions present.
			Turbidity NTU	50 (A&Ww)	2.37 - 1000	1 of 5		Flood conditions present.

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row	2000	<i>Escherichia coli</i> CFU/100 ml	580 (FBC)	4 - 16,000	1 of 4	Inconclusive	ADEQ collected 5 samples in 2000. Reach assessed as "attaining some uses" and added to the Planning List due to bacteria and turbidity exceedances.
	A&Ww Inconclusive FC Attaining FBC Inconclusive AgI Inconclusive AgL Inconclusive	5 sampling events	Fecal Coliform CFU/100 ml	4000 (A&Ww, AgL, AgI)	5 - 8000	1 of 4	Inconclusive	
			Turbidity NTU	50 (A&Ww)	2.37 - 1000	1 of 5	Inconclusive	
San Pedro River Aravaipa Creek-Gila River AZ15050203-001 A&Ww, FC, FBC, AgL	ADEQ Ambient and Bioassessment Below Eskiminzin Wash SPSPR003.74 100726	1998 - 1 suite 2000 - 5 suites	<i>Escherichia coli</i> CFU/100 ml	580 (FBC)	3-600	1 of 4		ADEQ collected 6 samples in 1998 - 2000. Reach assessed as "attaining some uses" and added to the Planning List due to bacteria and turbidity exceedances.
			Turbidity NTU	50	1.70 - 1000	1 of 6		
	Summary Row	1998 - 2000	<i>Escherichia coli</i> CFU/100 ml	580 (FBC)	3-600	1 of 4	Inconclusive	
	A&Ww Inconclusive FC Attaining FBC Inconclusive AgL Attaining	6 sampling events	Turbidity NTU	50 (A&Ww)	1.70 - 1000	1 of 6	Inconclusive	
Spring Canyon Creek headwaters to Mule Gulch AZ15080301-333 A&We, PBC	ADEQ TMDL Program At confluence with Mule Gulch RMSPC000.10	2000 - 1 DO, pH, total/dissolved cadmium, copper, lead, zinc	OK					Missing core parameters.
	Summary Row	2000 1 sampling event	OK				Not assessed	Insufficient sampling events and parametric coverage to assess.
Ward Canyon headwaters-Turkey Creek AZ15050201-433 A&Wc, FC, FBC, AgL	ADEQ Biocriteria Program Above Salisbury Canyon WPWRC000.31 100682	1998 - 1 suite	OK					
	Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient sampling events to assess.
Winwood Canyon headwaters-Mule Gulch AZ15080301-340 A&We, PBC	ADEQ TMDL Program At Mural Hill Tributary RMWMC000.66	2000 - 1 DO, pH, total/dissolved cadmium, copper, lead, zinc	Copper (dissolved) µg/l	22 (A&We)	28	1 of 1		
	ADEQ TMDL Program Above Old Mill Site, Below Mineralized Zone RMWMC000.37	2000 - 1 DO, pH, total/dissolved cadmium, copper, lead, zinc	pH (low) SU	6.5-9.0 (A&We, PBC)	6.02	1 of 1		

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row	2000	Copper (dissolved) µg/l	22 (A&Wc)	28	1 of 2	Inconclusive	ADEQ collected a total of 2 samples at 2 sites. Reach assessed as "Inconclusive" and added to the Planning List due to lack of sampling events, copper and pH exceedances, and missing core parameters.
	A&Wc Inconclusive PBC Inconclusive	2 samples 1 sampling event Missing core parameters	pH (low) SU	6.5-9.0 (A&Wc, PBC)	6.02	1 of 2	Inconclusive	
Whitewater Draw Mule Gulch-Mexico border AZ15080301-002 A&Ww, FC, FBC, Agl, AgL	ADEQ TMDL Program At border with Mexico RMWHD005.99 100512	1998 - 4 pH, arsenic, beryllium, copper, lead, manganese, zinc	OK					
	ADEQ TMDL Program At International Border RMWHD0.016 101069	2000 - 1 arsenic, beryllium	OK					
	ADEQ TMDL Program At Highway 80 RMWHD001.33 100510	1998 - 1 pH, arsenic, beryllium, copper, lead, manganese, zinc	OK					
	Summary Row A&Ww Inconclusive FC Inconclusive FEC Inconclusive Agl Inconclusive AgL Attaining	1998 - 2000 6 sampling events	OK					ADEQ collected a total of 6 samples at 3 sites in 1998-2000 as part of a TMDL investigation. Reach assessed as "attaining some uses" and added to the Planning List due to lack of core parameters.
Whitewater Draw Elfrida Highway-Mule Gulch AZ15080301-004 A&Ww, FC, FBC, Agl, AgL	ADEQ TMDL Program At Kings Highway RMWHD006.60 100229	1998 - 1 pH, arsenic, beryllium, copper, lead, manganese, zinc	Lead (total) µg/l	100 (AgL)	116	1 of 1		Missing core parameters.
	Summary Row	1998 1 sample	Lead (total) µg/l	100 (AgL)	116	1 of 1	Not assessed	Insufficient sampling events to assess.
LAKE MONITORING DATA								
Riggs Flat Lake AZL15050201-1210 A&Wc, FC, FBC, Agl, AgL	ADEQ Lakes Program WPRIG-A 100074	1998 - 2 suites	Turbidity NTU	10 (A&Wc)	0.8-17.4	1 of 1		Missing core parameters: Escherichia coli
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	1998 2 sampling events Missing core parameters	Turbidity NTU	10 A&Wc	0.8-17.4	1 of 1	Inconclusive	ADEQ collected 2 samples in 1998. Lake assessed as "Inconclusive" and added to the Planning List due to insufficient sampling events and core parameters.

TABLE 22. SAN PEDRO - WILLCOX PLAYA - RIO YAQUI WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Snow Flat Lake AZL15050201-1420 A&Wc, FBC, FC, Agl, AgL	ADEQ Lake Program WPSNO-A 100084	1998 - 2 suites	OK					Missing core parameters: Escherichia coli
	Summary Row A&Wc Inconclusive FC Inconclusive FBC Inconclusive Agl Inconclusive AgL Inconclusive	1998 2 samples Missing core parameters	OK				Inconclusive	ADEQ collected 2 samples in 1998. Lake assessed as "Inconclusive" and added to the Planning List due to insufficient sampling events and core parameters.

Information for interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from combining the following: AZ (for streams) or AZL (for lakes) + a US Geological Survey Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses," "Agency," and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year" is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
 - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria.) The chemical constituents monitored are not consistent among the many monitoring entities that provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
 - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
 - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters
- "Standards Exceeded at this Site per Sampling Event."
 - Although many parameters may be analyzed, only those exceeding a standard are shown. Other parameters were collected.
 - "OK" indicates that no standards were exceeded.
 - The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
 - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
 - A mean, geometric mean, or median will be shown along with the range of results if applicable to the standard or assessment criteria.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or "Inconclusive." See assessment criteria in Chapter III of Volume I.

Ground Water Assessments in the San Pedro-Willcox Playa-Rio Yaqui Watershed

Major Ground Water Pollutants -- Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 23** and illustrated in **Figures 42, 43, and 44**.

Of approximately 246 wells monitored, 18 exceeded fluoride standards, 12 exceeded standards for metals, 7 exceeded standards for radiochemicals, and 7 exceeded nitrate standards. **Figure 42** illustrates the location of the wells monitored and the wells exceeding standards. Exceedances occurred across the watershed, rather than in an isolated area; however, most of the radiochemical and fluoride exceedances occurred in the northern half of the watershed.

TDS Concentrations -- Water quality can be characterized based on concentration of Total Dissolved Solids (TDS). High levels of salinity limits the practical uses of ground water in some areas of this watershed as TDS over 500 mg/L has an off-flavor (23% of wells monitored), and TDS over 1000 mg/L will limit its use for some crops (7% of wells monitored). As illustrated in **Figure 43**, the elevated TDS is scattered across the watershed.

No TDS water quality standards apply in this watershed and the elevated levels of TDS do not present a human-health concern for drinking water. The TDS concentration is only used to generally characterize water quality.

Nitrate Concentrations -- Water quality can also be characterized by looking at the concentration of nitrates in ground water. In Arizona, natural occurring nitrate concentrations in ground water are generally below 3 mg/L and concentrations above 5 mg/L indicate potential anthropogenic sources of nitrates. A total of 27 wells of the 236 wells sampled (11%) exceeded the 5 mg/L concentration. As illustrated in **Figure 44**, elevated nitrates occur in the Willcox Playa area and scattered across the southern portion of this watershed. Irrigated agriculture, septic systems, and other wastewater disposal facilities are may be sources of this nitrate.

When nitrate concentrations exceed 10 mg/L, the water may present a health problem for babies and should not be consumed by nursing mothers. Seven wells exceeded this level. As many of the wells sampled are irrigation wells (not used for drinking water), nitrates over 10 mg/L may not represent a human-health concern in this watershed. However, efforts should be made to minimize further contamination of ground water by nitrate.

Table 23. San Pedro-Willcox Playa-Rio Yaqui Watershed Ground Water Monitoring 1996 - 2000

MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	54		5	9%
	Fluoride	126		4	3%
	Metals/Metalloids	126		0	0%
	Nitrate	126		5	4%
	VOCs + SVOCs*	62	4	0	0%
	Pesticides	62	0	0	0%
TARGETED MONITORING WELLS	Radiochemicals	38		2	5%
	Fluoride	115		14	12%
	Metals/metalloids	120		12	10%
	Nitrate	110		2	2%
	VOCs + SVOCs*	37	0	0	0%
	Pesticides	37	0	0	0%

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline). Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
223	172	36	12	3

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
236	209	20	7

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.

*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.

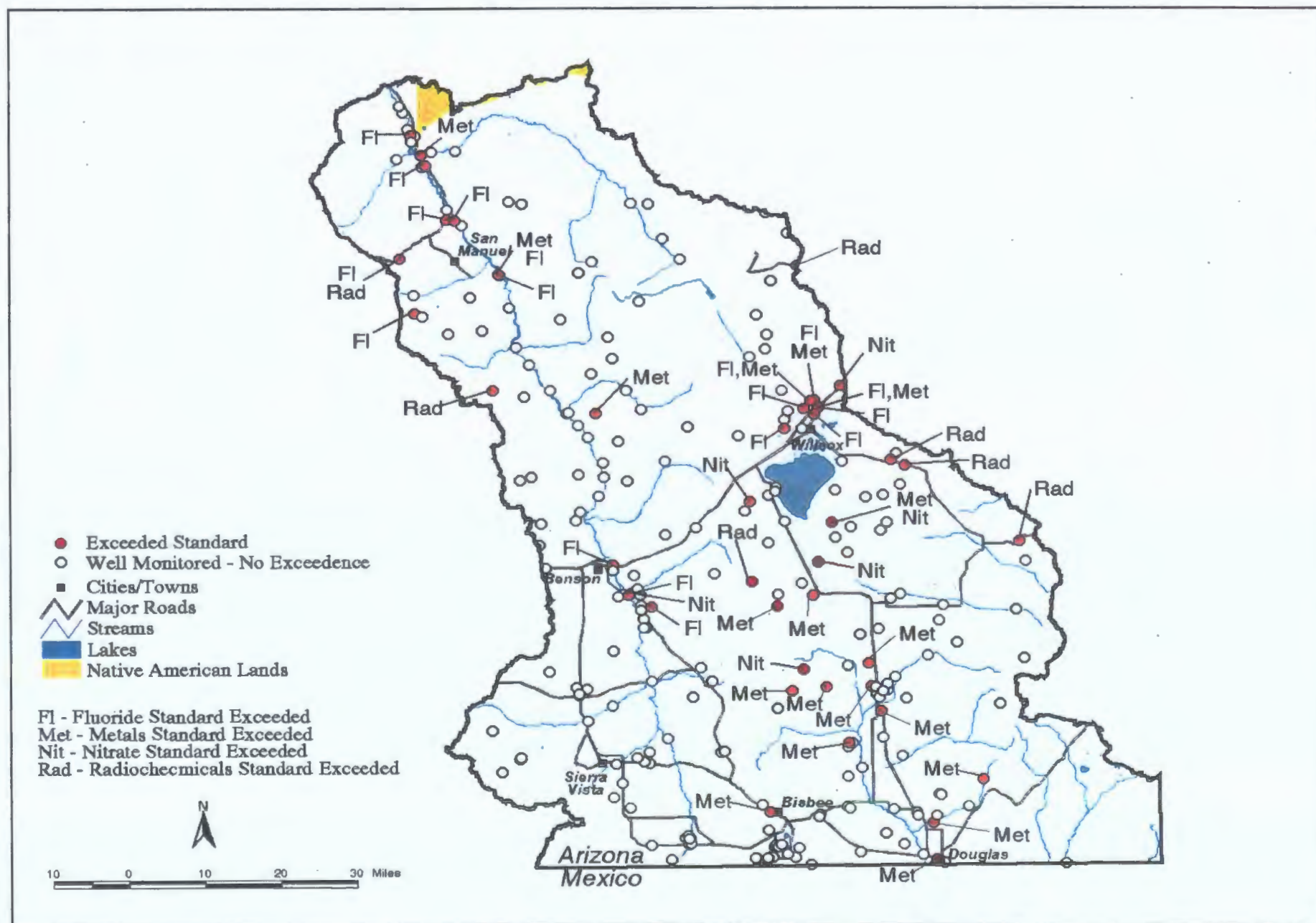


Figure 42. Ground Water Monitoring in the San Pedro-Willcox Playa-Rio Yaqui Watershed – 1996-2000

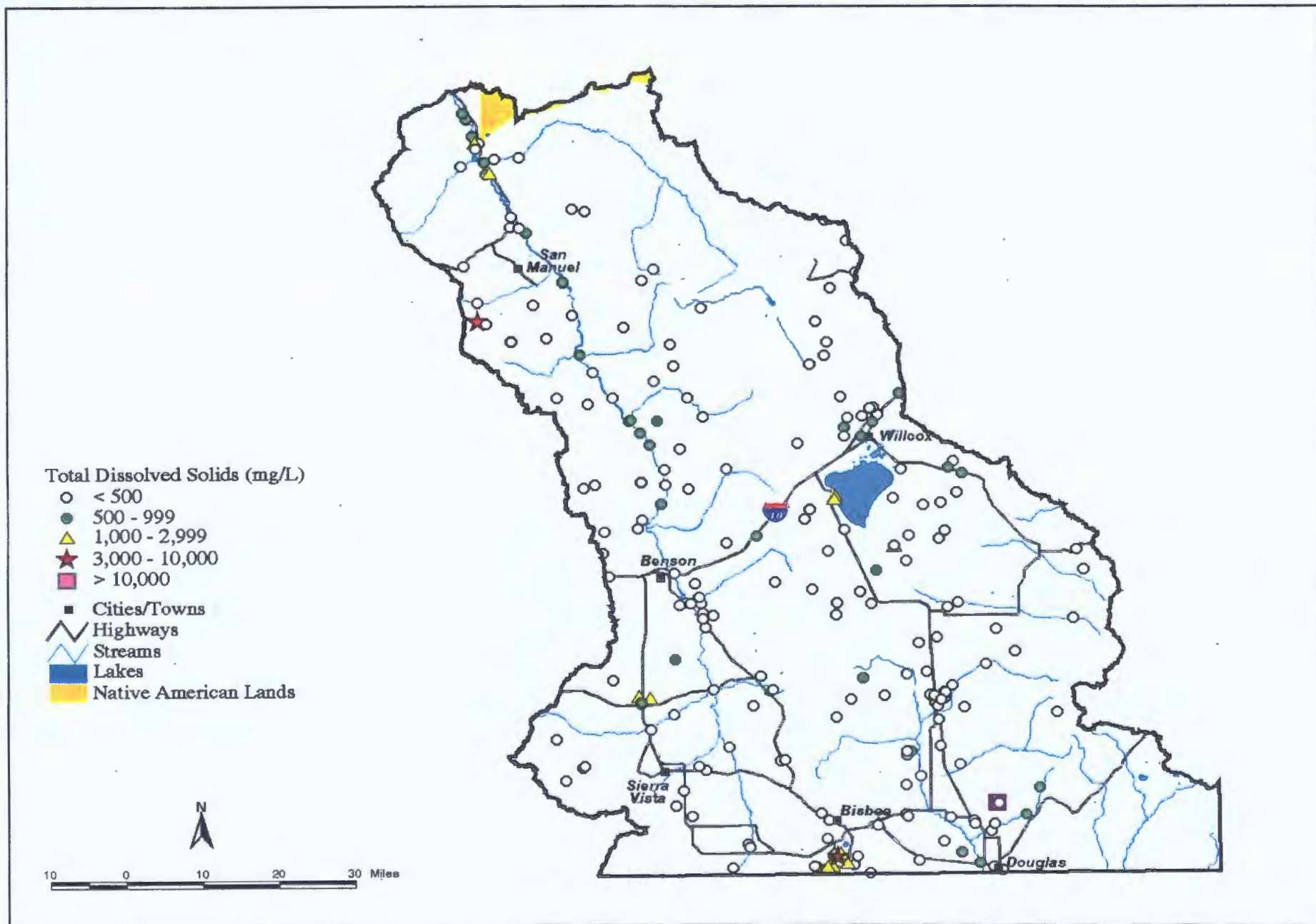


Figure 43. Classification of Ground Water Quality by TDS Concentration in the San Pedro-Willcox Playa-Rio Yaqui Watershed

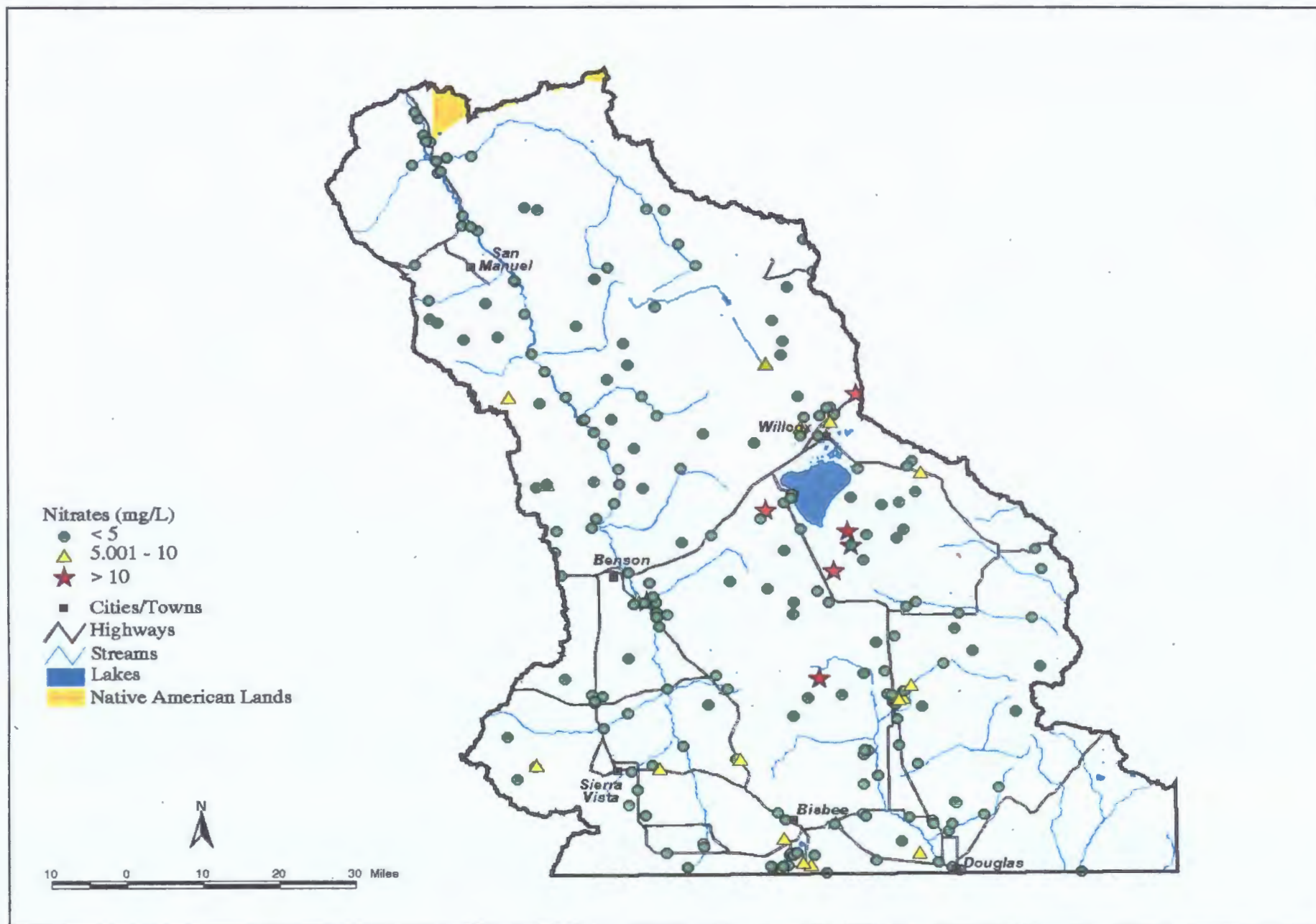


Figure 44. Classification of Ground Water Quality by Nitrate Concentration in the San Pedro-Willcox Playa-Rio Yaqui Watershed

Watershed Studies and Alternative Solutions in the San Pedro-Willcox Playa-Rio Yaqui Watershed

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the San Pedro-Willcox Playa-Rio Yaqui Watershed. Watershed partnerships active in this watershed are also discussed.

Surface Water Studies and Mitigation Projects

Total Maximum Daily Load Analyses – Two TMDL studies are ongoing in this watershed. Further information about the status of these investigations can be obtained by contacting the TMDL Program manager at (602) 771-4468, or at ADEQ's web site: <http://www.adeq.state.az.us/environ/water/assess/tmdl.html>

- **Mule Gulch TMDL** – Mule Gulch was included on the 1998 303(d) List due to impairment by copper, zinc, and low pH. To develop a TMDL for this surface water, eighteen water samples have been collected since 1998 from seven sites along Mule Gulch from its headwaters to Whitewater Draw. ADEQ expects to complete a draft TMDL in the Fall of 2001.

NAWQA Study – Samples were collected in this watershed as part of the US Geological Survey's National Water Quality Assessment Program. This study included sites in the Middle Gila, Santa Cruz-Rio Magdalena-Rio Sonoyta, and Verde watersheds. See the discussion of this research effort in the statewide studies section at the beginning of Volume II.

Water Protection Fund Projects – The following projects received Water Protection Funds from the Arizona Department of Water Resources:

- **San Pedro Riparian National Conservation Area Watershed Rehabilitation and Restoration Project** – The Bureau of Land Management (BLM) was awarded funds to rehabilitate and restore approximately 4,450 acres of eroded, ephemeral washes and upland areas that are within a mile of the San Pedro River within the San Pedro Riparian National Conservation Area. This was accomplished by recontouring ephemeral washes and adjacent uplands and by revegetating these areas with native plant species. The project was completed in April 2000.

- **San Pedro Riparian National Conservation Area Watershed Protection and Improvement Project** – The BLM was awarded funds to improve, enhance and protect the riparian habitats and water quality in the San Pedro National Riparian Conservation Area. Part of the funds were spent on fencing off 36 miles of the San Pedro River from livestock. This project will enhance the riparian ecosystem and associated wildlife habitats without undue impacts to upland grazing allotments. The project was completed in September 1998.
- **San Pedro River Preserve Riparian Habitat Restoration Project** – The intent of this project is to enhance and protect existing riparian forest along three miles of the San Pedro River. The Nature Conservancy restored native grassland communities on the river slopes and terraces, determined the need for mechanical stabilization measures and implemented measures to stabilize river banks and re-established native riparian vegetation in areas of defunct aquiculture ponds and agricultural fields on a site encompassing 860 acres. The Conservancy also developed and demonstrated new techniques for restoring abandoned agriculture fields to riparian habitat. The project was completed in August 2001.
- **Teran Watershed Enhancement Project** – The Redington Natural Resource Conservation District received funds to improve watershed conditions within the Teran sub-watershed, located along the San Pedro River. Thousands of small, loose-rock dam structures have been constructed in an attempt to reduce surface water runoff rates, increase duration of channel flow, improve ground water recharge and enhance habitat for wildlife. The project was completed in April 1999.
- **Klondyke Tailings Response Strategy Analysis** – A team of scientists led by ADEQ collected data to determine the extent of impact on Aravaipa Creek from runoff or leaching of contaminated mine tailings at the Klondyke Mine tailings pile. The team developed a response strategy to determine the best methods of treating the tailings pile to reduce or prevent ground water and stream contamination by leaching, runoff or erosion of the tailings into the stream. This investigation was completed in 1998.

- Happy Valley Riparian Restoration Area Restoration Project – The Paige Creek riparian area in Happy Valley is a unique, large riparian gallery located on the east side of the Rincon Mountains. The Coronado National Forest received a grant to fence the riparian area, create upland water sources for grazing wildlife, construct an in-stream structure to reduce water velocity, and construct a pipe barrier fence to restrict vehicle access to sensitive areas. This project which was completed in July 1999.
- Lyle Canyon Allotment Restoration Project – A private land owner was awarded funds to restore and protect the riparian areas on the Lyle Canyon Allotment through the installation of a variety of range improvements, including fences and upland water developments that will better distribute cattle grazing in the upland portions of the allotment and away from the riparian areas. The grantee and the University of Arizona Cooperative Extension Office have developed a monitoring plan to record the condition of riparian and upland habitats on the Lyle Canyon Allotment. The monitoring plan includes a quantitative assessment of the riparian and upland vegetation, a “Proper Functioning Condition” assessment of the riparian areas, and photo point monitoring. If livestock grazing management changes are indicated by the monitoring data the grantee will coordinate with the U.S. Forest Service to incorporate those into the Allotment Management Plan. The project was completed in October 2001.

Water Quality Improvement Grants – ADEQ awarded the following Water Quality Improvement Grants in this watershed:

- Upper Whitewater Draw Treatment and Management Project – The Whitewater Draw Natural Resource Conservation District received a grant to reduce erosion and siltation and enhance riparian conditions within Whitewater Draw through the following actions:
 - ▶ Improve understory and range vegetation by 50% or greater on 160 acres within the upper Whitewater Draw project area due to brush management techniques such as clearing and snagging;
 - ▶ Implement livestock rotation and exclusion range management practices;
 - ▶ Install 6000 feet of contoured swales;
 - ▶ Add fluvial geomorphology and grade stabilization structures;

- ▶ Repair a flood retarding structure; and
- ▶ Install several small rock weirs as grade stabilization structures.

An educational and outreach component is also present. The project is scheduled for completion in 2002.

- San Pedro Watershed Stewardship Project – The Arizona Association of Conservation Districts received funds to reduce erosion and siltation and enhance riparian conditions and stream channel stability within the San Pedro River and its tributaries. Along with an educational component, the following actions are to be completed in 2002:
 - ▶ Install grade stabilization structures and reshape a portion of a tributary channel; and
 - ▶ Replant several riparian and flood plain areas with native plant species (range seeding).
- Turbidity Reduction in Aravaipa Creek Through a Watershed Treatment Project – Coronado Resource Conservation and Development was awarded a grant to address sheet and rill erosion in a 60,000 acre drainage area along the headwaters of Aravaipa Creek. Slowing the rate of runoff reaching existing gullies along the creek will keep the gullies from increasing in size. The objective of slowing runoff by improving vegetation in the lower areas will be met by implementing the following management practices:
 - ▶ Install fencing to divide the area into smaller pastures with water supplied in the uplands encouraging cattle to utilize these areas;
 - ▶ Adjust grazing practices so that a higher concentration of cattle will be on each pasture for a shorter length of time. This should improve soil tilth, and allowing seed germination and vegetative regrowth; and
 - ▶ Use fencing to limit cattle access to the creek. This should result in enhanced riparian vegetation that traps sediment and multiple benefits to wildlife.

A second phase is being planned which will address existing gullies and head cuts. Establishment of a riparian community will play a key role in both phases of erosion treatment in the area through its role in bank stabilization and sediment trapping to reduce turbidity and provide cleaner water to the system.

- Borderlands Storm Water Runoff Control Project – A 2500 acre parcel, between the international border with Mexico and the San Pedro River, will undergo range seeding to increase vegetation and act as a sediment control buffer strip. This should reduce degradation of the Bureau of Land Management's San Pedro Riparian National Conservation Area. The Coronado Resource Conservation and Development is coordinating the implementation of this project with the San Jose Ranch, Hereford Natural Resource Conservation District, the Bureau of Land Management, and the Natural Resource Conservation Service. This project is scheduled for completion in 2003.
- Peppersauce Cave and Cave Water Restoration Project – Peppersauce Cave in Coronado National Forest has permanent pools in three rooms. Two water samples indicated the presence of fecal coliform and *Escherichia coli* contamination. Peppersauce Cave is easily the most visited wild cave in Arizona with the US Forest Service reporting up to 23,000 visits per year. The grant will be used to clean the water, remove the litter and graffiti, create and distribute educational material to reverse the long-standing destruction, erect a kiosk, and encourage current users of the cave to help in these efforts. This project is to be completed in 2003.

Sonoran Desert Conservation Plan -- Pima County developed the Sonoran Desert Conservation Plan in 1999. The objective of the plan is to coordinate short-term actions through long-range planning to ensure that natural and urban environments not only coexist but develop an interdependent relationship where one enhances the other. The action plan is to guide approved public bond investment and preservation actions, establish federal program and funding priorities, and develop our region's preference for the expenditure of state funds to preserve and protect State Trust lands threatened by urbanization. The following projects are associated with this plan:

- Bingham Cienega Riparian Restoration Project -- In the summer of 1998, Pima County and the Nature Conservancy began a three-year project to restore sacaton grasslands, willow forests, and mesquite woodland, at Bingham Cienega Natural Preserve. With help from volunteers and a wide variety of state, federal, and private funding, 50 acres of former farm fields are being transformed to native vegetation with benefits expected for water quality.

- The Bingham Cienega Natural Preserve – This preserve was established when the Pima County Flood Control District acquired lands along the San Pedro River to preserve a natural spring-fed marsh known as the Bingham Cienega. Because of the site's remote location and sensitive environment, the district entered into a long-term agreement with The Nature Conservancy to manage the property. Conservancy volunteers fenced out livestock, and once vegetation began to fill in drainage channels, the marsh began to spread. The District installed a small check dam that has successfully arrested erosion that threatened rapid sedimentation of the marsh.
- San Pedro River Protection Project -- Further protection of the San Pedro River is proposed. In conjunction with the Arizona Chapter of the Nature Conservancy, Pima County will acquire additional land or conservation easements along the San Pedro River from willing sellers. Bonds in the amount of \$1 million will be sold to preserve riparian areas near Bingham Cienega and Buehman Canyon. Additional lands may also be set aside. The protection and/or restoration of riparian corridors will serve to slow runoff and reduce excessive sedimentation of the San Pedro River while enhancing habitat for native wildlife.
- Other water course protection projects will be explored when the Pima County Flood Control District works with landowners to protect the flood prone areas from future development through conservation easements and acquisitions. Using bonds approved by voters in 1997, lands along Sabino Creek, Honey Bee Wash, Bear Canyon, Tanque Verde Wash, San Pedro River, and Agua Caliente Wash will be preserved, protecting and/or enhancing water quality. Pima County will encourage the setting aside of state trust land along significant corridors such as Cienega Creek, Mescal Arroyo, Davidson, and Penitas Wash, among others.

The US Fish and Wildlife Service Aravaipa Creek Study – The USFWS analyzed fish tissue to document and assess current levels of selected metal contaminants in fish from Aravaipa Creek and trends in contaminants by comparing the results with data collected by ADEQ in 1993. Samples were collected from the Nature Conservancy property on Aravaipa Creek in 1997. Although arsenic, cadmium, and lead were detected in the fish well above background, none were at concentrations likely to adversely affect fish health and reproduction. Mercury was not even detected in the fish samples (lab detection level was 0.25 µg/g).

Ground Water Studies and Mitigation Projects

Ground Water Quality in the Sierra Vista Subbasin, Arizona – Thirty-nine ground water samples were collected and analyzed in 1996-1997 by the U.S. Geological Survey and ADEQ for the purpose of assessing ground water quality and contaminant source identification within the Sierra Vista subbasin. Review of analytical results indicated that fluoride, iron, manganese, pH, sulfate, and total dissolved solids exceeded state water quality standards. Significant variation was observed in ground water quality with respect to well location, well depth and aquifer type; however, sodium, fluoride, and potassium concentrations were higher in the northern part of the subbasin as compared to the southern. For more information, please contact the ADEQ Ground water Monitoring Unit at (602) 771-4412.

Willcox Basin Baseline Study – The Willcox Basin is 1,911 square miles area delineated by rugged mountains at its fringes and a 29,500 acre playa in its center. The majority of groundwater pumped is for irrigation use. Ground water generally flows from mountain fronts toward the Willcox playa, though heavy irrigation pumping has partially altered this flow and created ground water depressions in intensively farmed areas.

ADEQ conducted a regional ground water quality study of the Willcox Basin in 1999. A total of 58 sites were sampled: 41 randomly-selected sites and 17 targeted sites. Sites were targeted to investigate arsenic and fluoride levels northeast of Willcox and the relationship of parameter concentrations to ground water depth in the Kansas Settlement District. Of the 58 sites sampled, 21 had parameter levels exceeding Arizona's Ground Water Protection Standards (Figure 77). Well owners should be particularly concerned about elevated parameter concentrations in the following portions of the basin:

- Fluoride, arsenic, and pH near the Spike E. Hills northeast of Willcox;
- Gross alpha in areas of granitic rock throughout the basin;
- Nitrate, fluoride, and sulfate northwest of Sulphur Hills; and
- Chloride and sulfate west of the Willcox Playa.

Although only limited trend analyses were conducted, parameters in most of the basin do not appear to vary significantly in the short term. However, trends in the Kansas Settlement District indicate that ground water quality seems to be influenced by nitrate and salts carried by excess irrigation water that ultimately recharges the ground water.

Douglas Basin Baseline Study – This basin covers 950 square miles and extends south hydrologically into Mexico; however the international border serves as the southern edge of this basin for reporting purposes. This basin includes Bisbee and Douglas which were historically important copper mining and or processing centers and Elfrida and McNeal which are agriculturally-oriented small towns.

To characterize regional ground water quality, 51 sites were sampled: 29 randomly-selected sites and 22 targeted sites. Out of the 51 sites, only three sites exceeded Arizona's Aquifer Protection Standards: arsenic (1 site) beryllium (1 site) and nitrate (1 site).

Nitrate was elevated over 3 mg/L at 21 of the sites, with may indicate impacts from human activities. Areas with the highest nitrate levels included the intensively farmed areas near Elfrida and in the foothills of both the Dragoon and Mule mountains.

Four areas were targeted for more intensive sampling to examine potential effects on ground water quality from various land uses:

- No effects from a landfill near Elfrida were discerned; however, six of the nine targeted wells had elevated nitrate levels. Agricultural activities and septic systems were assumed to be the source of the elevated nitrates;
- Mine tailings appear to be contributing to elevated sulfate in the ground water down gradient of the town of Bisbee;
- Six sites near Douglas showed no impacts from either municipal activities or slag waste from a copper smelter; and
- A targeted area east of the Bisbee-Douglas Airport unexpectedly showed influences from geothermal activities with very high temperatures, and high levels of total dissolved solids (14,000 mg/L), sulfate (5,020 mg/L), ammonia (1.09 mg/L), and iron (13.9 mg/L).

Although ground water in the basin generally met water quality standards, ADEQ suggests that well owners periodically have their ground water analyzed by a certified laboratory.

Federal and State Superfund Cleanup Sites – Three Superfund and Department of Defense cleanup sites are located in this watershed.

- Klondyke Tailings – In the unincorporated community of Klondyke, this site is located on the north bank of Aravaipa Creek, approximately 4.5 miles upstream of the Aravaipa Canyon Wilderness Area. The site encompasses two piles of mine tailings and adjacent soil, including an area approximately 50 feet into the stream bed of Aravaipa Creek.

The site was listed on the WQARF registry in 1998 due to various metals left in the tailings. Metals present at concentrations higher than Arizona's Aquifer Protection and Soil Remediation standards include: lead, cadmium, antimony, beryllium, copper, manganese, and arsenic. There is physical evidence that runoff, leaching, and flood erosion of contaminated tailings may be impacting Aravaipa Creek; however, no water quality samples were available for assessment purposes. This project is still in the investigation phase.

- Apache Powder – The Apache Powder Superfund site is located approximately two and a half miles southwest of St. David, Arizona. The site covers approximately nine square miles, including 945 acres of land owned by Apache Nitrogen Products, Inc. (formerly known as the Apache Powder Company). The San Pedro River bounds the eastern side of the site. Contaminants of concern found at this site include: arsenic, fluoride, and nitrate in the perched aquifer; nitrate in the shallow aquifer; arsenic, antimony, barium, beryllium, chromium, lead, manganese, and nitrate in the inactive pond soils and sediments; and two variants of dinitroglycerine and lead in "wash area 3." Additionally, vanadium pentoxide and trinitroglycerine were found in the soils on the site and perchlorate has been found in the perched and shallow aquifers.
- Fort Huachuaca – The Department of Defense has been studying Fort Huachuca, an US Army post located in Sierra Vista. Originally 20 hazardous waste and leaking underground storage tank sites were identified. Of these, fifteen have been cleaned up or require no further action, and only five sites are undergoing remediation or further monitoring.

Watershed Partnerships

The Upper San Pedro Partnership -- This partnership was formed to facilitate and implement sound water resource management and conservation strategies in

the Sierra Vista area within the Upper San Pedro River Groundwater Basin. It is a consortium of agencies that own or manage water resources in the Sierra Vista area and agencies that can provide resources to help the partnership accomplish its purpose.

The purpose of the Upper San Pedro Partnership is to coordinate and cooperate in the identification, prioritization and implementation of comprehensive policies and projects to assist in meeting water needs in the Sierra Vista sub-watershed of the Upper San Pedro River Basin. Although the general focus of the partnership concentrates on issues pertaining to water quantity, water quality issues are also a component. For more information on the Upper San Pedro Partnership, please contact George Michael at (520) 378-4046.

The Middle San Pedro Partnership – This is a newly formed partnership focused on improving water quality of the Middle San Pedro River through the implementation of Water Quality Improvement Grant projects and cooperation with local land owners. For more information on the Middle San Pedro Partnership, please contact Barbara Clark at (520) 212-2529.

Campomoch-Sacaton Watershed Group – The Campomoch-Sacaton Watershed Group is also a newly formed organization focused on improving water quality of the Middle and Lower San Pedro River through the implementation of Water Quality Improvement Grant projects and cooperation with local landowners. Representation in this watershed group includes the United States Forest Service, Natural Resource Conservation Service, local landowners, Arizona State Land Department, Cochise County, City of Willcox, Arizona Cattlegrowers, Arizona Game and Fish Department, Coronado Resource Conservation & Development, Willcox-San Simon Conservation District, and the University of Arizona Extension. A principle contact has not been appointed to date.

Cottonwood Canyon Watershed Group – This work group is a newly formed and focused on improving water quality and restoring the flow of Cottonwood Creek through the implementation of Water Quality Improvement Grant projects and cooperation with local landowners. Representation in the Cottonwood Canyon Watershed Group includes the United States Forest Service, Natural Resource Conservation Service, local landowners, Willcox-San Simon Natural Resource Conservation District, Cochise County, Coronado Resource Conservation & Development, Sunglow Guest Ranch, Smith Ranch and the University of Arizona Extension. A principle contact has not been appointed to date.

Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed



SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED CHARACTERISTICS

SIZE	11,096 square miles (10% of the State's land area).					
POPULATION BASE	Approximately 933,811 people live in this watershed (estimated from the 2000 census). This is about 18% of the state's population.					
LAND OWNERSHIP (Figure 45)	Tribal	39%	US Forest Service	10%	Other state and federal	3%
	Private	22%	Bureau of Land Management	6%	Military lands	1%
	State	15%	National Wildlife Refuge	4%		
LAND USES AND PERMITS (Figure 46)	<p>Most of the population in this watershed is clustered around metropolitan Tucson (approximately 844,000 people), the state's second largest city. However, the combined population of Nogales in Arizona and in Sonora Mexico would be approximately 370,000, with 94% of this population in Mexico. Grazing and irrigated crop production (near stream beds) are the dominant land uses. Some of the agricultural land has been converted to urban use or retired where water rights have been purchased by mining or urban interests. Active mining is scattered across this watershed, but varies with the current market price. In addition, several abandoned mines are located within this watershed, several of which are under investigation as probable contributors of nonpoint source pollution.</p> <p>This watershed includes eight designated wilderness areas, along with National Forests and National Monuments with restricted land uses.</p>					
HYDROLOGY AND GEOLOGY	<p>This watershed is a composite of two surface water basins: 1) The Santa Cruz which flows north to the Gila River and 2) The Rio Magdalena and Rio Sonoyta drainage areas which flow south into Mexico. The maximum discharge of the Santa Cruz River is 33,000 cfs (in 1983 near its confluence with the Gila River). In recent years, no flow has been measured during most of the year (USGS 1996). Extensive ground water pumping has eliminated natural perennial flow in most of the Santa Cruz River. Wastewater provides perennial flow below discharges from the cities of Nogales (Arizona and Sonora, Mexico) and Tucson (Brown et al. 1978).</p> <p>Ground water basins and active management areas include: Cienega Creek, San Rafael, San Simon Wash, Tucson AMA, Santa Cruz AMA, Pinal AMA, and West Mexican Drainage. Generally, basin-fill sediments comprise the productive and widely used aquifers. Only minor amounts of ground water are found in the surrounding hardrock mountains in thin alluvial valley deposits and fractured bedrock (ADWR 1994).</p> <p>The primary Hydrologic Province is the Southern Basin and Range, with the southeastern corner of the watershed in Southern Deserts. This area is characterized by broad, gently-sloping alluvial basins, separated by fault block mountains that trend to the north to northwest.</p>					
UNIQUE WATERS	Cienega Creek (downstream portion)					
HYDROLOGIC PROVINCE(S)	Basin and Range Province.					
OTHER STATES, NATIONS, OR TRIBES	<p>This drainage area flows into the Middle Gila Watershed to the North. The headwaters of the Santa Cruz River flow south into Mexico for a distance before returning to the United States.</p> <p>Tohono O'odham, San Xavier, Pascua Yaqui, Ak Chin, and Gila River tribes are significant stakeholders in this watershed, occupying a 39% of the watershed.</p>					

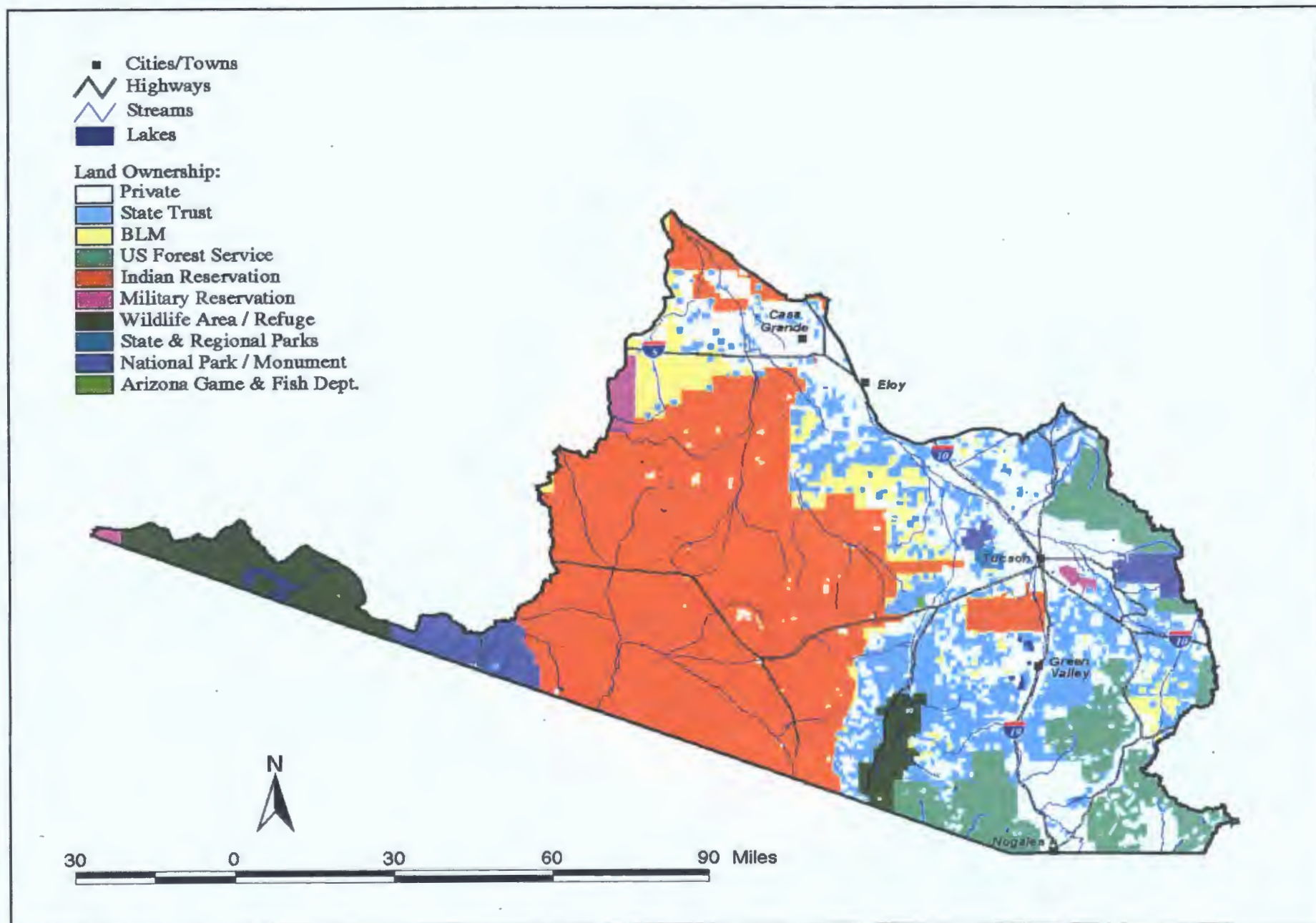


Figure 45. Land Ownership in the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed

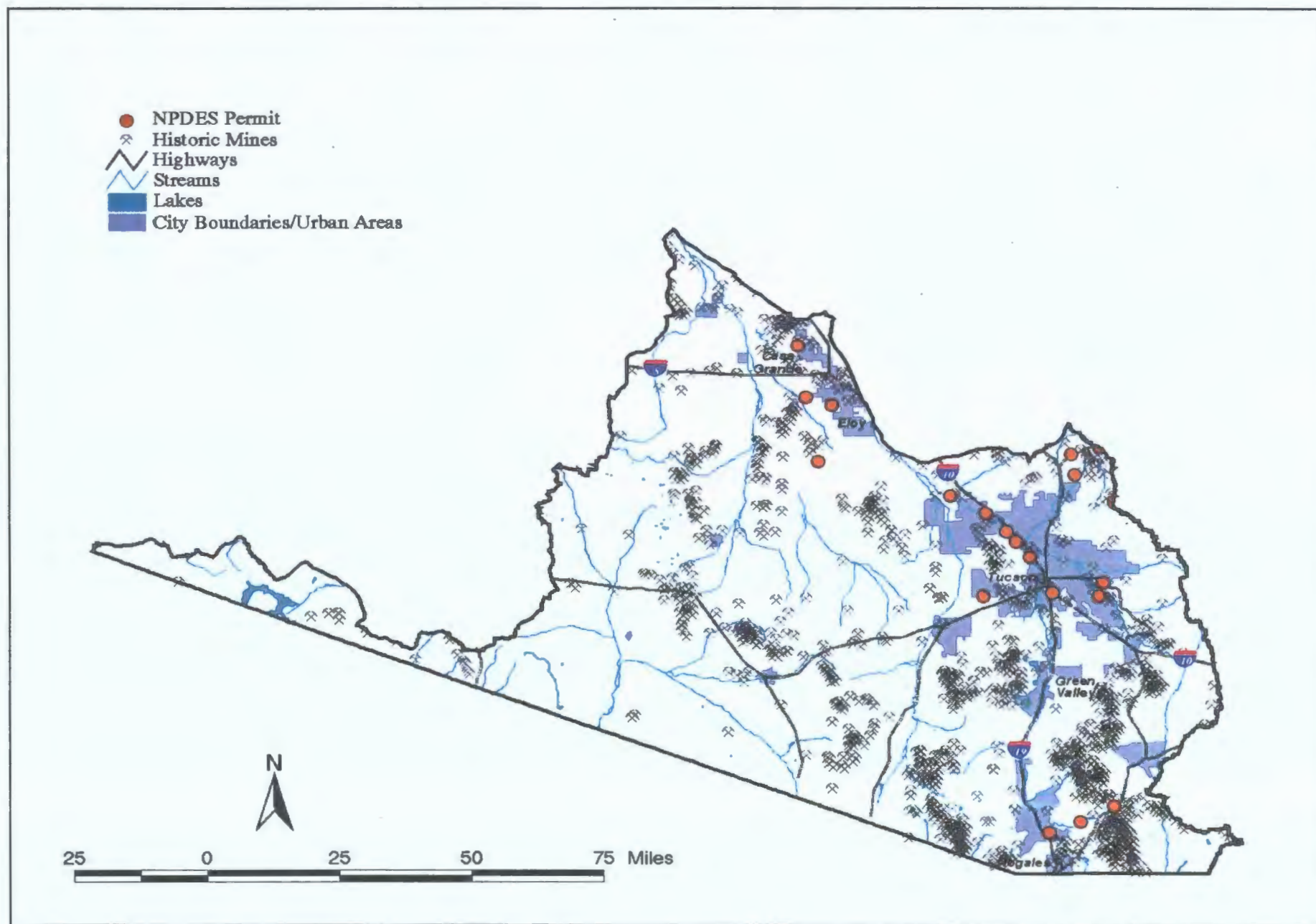


Figure 46. General Land Use and NPDES Permits in the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed

Santa Cruz-Rio Magdalena, Rio Sonoyta Watershed Assessment Discussion

Statistical Summary of Surface Water Assessments

Assessments – For the 2002 assessment, 168 miles of streams or washes and 552 acres of lakes were assessed. This assessment does not include the monitoring data generated in 2001 when this was one of two focus watersheds. That data will be included in the next assessment cycle.

Water quality assessment information for the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed is summarized in the following tables and illustrated in Figure 47.

Table 24. Assessments in the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed – 2002

	STREAMS		LAKES	
	miles	number of segments	acres	number of lakes
ATTAINING	19	1	383	4
INCONCLUSIVE	100	8	7	1
IMPAIRED	69	10	0	0
NOT ATTAINING	0	0	169	2
TOTAL ASSESSED	188	19	559	7

PERENNIAL SURFACE WATERS ASSESSED		STREAMS		LAKES	
		miles	number of segments	acres	number of lakes
	Assessed	122	8	559	7

* Note that streams with significant perennial stretches within the reach assessed were included in the perennial mileage although part of the reach may have ephemeral or intermittent flow.

Inconclusive Assessments – Surface waters with some monitoring data, but insufficient data to determine if a designated use is attaining or impaired, were added to the new Planning List. By the end of the next watershed monitoring

cycle (scheduled in 2006), ADEQ expects to monitor most of these reaches so that all designated uses can be assessed during the following assessment cycle. Other lakes and streams which lack monitoring data will also be monitored depending on resources and priorities.

ADEQ will be working with US Geological Survey and the Arizona Game and Fish Department, so that their future monitoring efforts will better support Arizona's surface water assessments.

Major Stressors – When a surface water is listed as impaired or not attaining a designated use, the pollutants or suspected pollutants causing the impairment are identified. The reaches and lakes assessed as impaired or not attaining their uses in this watershed can be divided into four groups based on pollutants and their probable sources:

- Deteriorated municipal wastewater infrastructure in Mexico and the under-designed Nogales International Wastewater Treatment Facility has lead to six stream reaches (51 miles) being assessed as impaired by bacteria, chlorine, and/or cyanide. (See Border Program discussion in Chapter VII of Volume 1.)
- Historic mining activities have cause impairment of four stream reaches (19 miles) due to metals (primarily copper and zinc).
- Mercury contamination of fish tissue has lead to fish consumption advisories and mercury TMDLs at two lakes, Arivaca and Pena Blanca. Historic deposition, air deposition, and mercury cycling in the lakes have contributed to this problem. Further monitoring is being scheduled to determine the effectiveness of TMDL implementation strategies.
- High turbidity is also impairing Nogales Wash.



Figure 47. Santa Cruz-Rio Magdalena, Rio Sonoyta Watershed 2002 Assessments

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
STREAM MONITORING DATA								
Alum Gulch headwaters-ephemeral reach AZ15050301-561A A&Ww, FC, FBC, AgL	ADEQ TMDL Monitoring Below World's Fair Mine SCALG004.61 100870	1999 - 1 field, dissolved/total cadmium, copper, zinc 2000 - 1 field, dissolved/total cadmium, copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC, AgL)	3.2 - 3.2	2 of 2		Not all core parameters sampled.
			Cadmium (dissolved) µg/L	115 (A&Ww)	170 - 220	2 of 2		
			Cadmium (total) µg/L	41 - FC 50 - AgL 70 - FBC	170 - 290	2 of 2 2 of 2 2 of 2		
			Copper (dissolved) µg/L	65 (A&Ww)	1600 - 2000	2 of 2		
			Copper (total) µg/L	500 (AgL)	1900 - 2100	2 of 2		
			Zinc (dissolved) µg/L	379 (A&Ww)	49,000 -53,000	2 of 2		
			Zinc (total) µg/L	22,000 - FC 25,000 - AgL 42,000 - FBC	45,000-54,000	2 of 2 2 of 2 2 of 2		
	ADEQ TMDL Monitoring Below January Adit SCALG004.82 100317	1998 - 3 field, dissolved/total cadmium, copper, zinc (4) nutrients	Cadmium (total) µg/L	41 - FC 50 - AgL 70 - FBC	27 - 191	2 of 3 2 of 3 2 of 3		Not all core parameters sampled.
			Copper (dissolved) µg/L	56 - 305 (A&Ww)	1600 - 2000	3 of 3		
			Copper (total) µg/L	500 (AgL)	1900 - 2100	3 of 3		
			Zinc (dissolved) µg/L	328 - 1512 (A&Ww)	49,000 -53,000	3 of 3		
			Zinc (total) µg/L	22,000 - FC 25,000 - AgL 42,000 - FBC	7,680 - 54,900	2 of 3 2 of 3 2 of 3		
	ADEQ TMDL Monitoring Below Alum Falls and above World's Fair Mine SCALG004.98 100836	1999 - 1 field, dissolved/total cadmium, copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC, AgL)	3.5	1 of 1		Not all core parameters sampled.
			Cadmium(dissolved) µg/L	115 (A&Ww)	160	1 of 1		
			Cadmium (total) µg/L	41 - FC 50 - AgL 70 - FBC	160	1 of 1 1 of 1 1 of 1		

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Copper (dissolved) µg/L	65 (A&Ww)	1500	1 of 1		
			Copper (total) µg/L	500 (AgL)	1400	1 of 1		
			Zinc (dissolved) µg/L	379 (A&Ww)	46,000	1 of 1		
			Zinc (total) µg/L	22,000 - FC 25,000 - AgL 42,000 - FBC	49,000	1 of 1 1 of 1 1 of 1		
	ADEQ TMDL Monitoring Below Humboldt Canyon, and above Alum Falls SCALG005.30 100837	1999 - 1 field, dissolved/total cadmium, copper, zinc	Cadmium(dissolved) µg/L	115 (A&Ww)	150	1 of 1		Not all core parameters sampled
			Cadmium (total) µg/L	41 - FC 50 - AgL 70 - FBC	180	1 of 1 1 of 1 1 of 1		
			Copper (dissolved) µg/L	65 (A&Ww)	1200	1 of 1		
			Copper (total) µg/L	500 (AgL)	1200	1 of 1		
			Zinc (dissolved) µg/L	379 (A&Ww)	44,000	1 of 1		
			Zinc (total) µg/L	22,000 - FC 25,000 - AgL	41,000	1 of 1 1 of 1		
			pH SU	6.5 - 9.0 (A&Ww, FBC, AgL)	3.6	1 of 1		
	ADEQ TMDL Monitoring Above Humboldt Canyon SCALG005.58 100838	1999 - 1 field, dissolved/total cadmium, copper, zinc 2000 - 1 field, dissolved/total cadmium, copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC, AgL)	4.5 - 5.3	2 of 2		Not all core parameters sampled.
			Cadmium(dissolved) µg/L	115 (A&Ww)	120 - 170	2 of 2		
			Cadmium (total) µg/L	41 - FC 50 - AgL 70 - FBC	140 - 180	2 of 2 2 of 2 2 of 2		
			Copper (dissolved) µg/L	65 (A&Ww)	110 - 400	2 of 2		
			Dissolved oxygen mg/L	6 (90% saturation) (A&Ww)	0.49 - 7.1 (73 - 84% saturation)	1 of 2		

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
			Zinc (dissolved) µg/L	379 (A&Ww)	39,000 -56,000	2 of 2		Not all core parameters sampled.
			Zinc (total) µg/L	22,000 - FC 25,000 - AgL 42,000 - FBC	42,000-56,000	2 of 2 2 of 2 1 of 2		
	ADEQ TMDL Monitoring Below Trench Camp Mine and above January Adit SCALG005.90 100839	1999 - 1 field, dissolved/total cadmium, copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC, AgL)	5.9	1 of 1		Not all core parameters sampled.
			Zinc (dissolved) µg/L	127 (A&Ww)	2500	1 of 1		
	Summary Row A&Ww Impaired FC Inconclusive FBC Inconclusive AgL Inconclusive	1998-1999 10 samples 5 sampling events Missing core parameters	pH SU	6.5 - 9.0 (low) (A&Ww, FBC, AgL)	3.2 - 5.9	7 of 7	Inconclusive	ADEQ collected 10 samples at six sites from 1998 - 2000. Reach is assessed as impaired due to dissolved metals. Reach is also added to the Planning List for total metals, low pH, and missing core parameters.
			Cadmium (dissolved) µg/L	Varies (A&Ww)	56 - 220	6 of 10	Impaired	
			Cadmium (total) µg/L	41 - FC 50 - AgL 70 - FBC	27 - 290	8 of 9 8 of 9 8 of 9	Inconclusive	
			Copper (dissolved) µg/L	Varies (A&Ww)	110 - 2000	9 of 10	Impaired	
			Dissolved oxygen mg/L	6 (90% saturation) (A&Ww)	0.5 - 7.1 (73 - 84% saturation)	1 of 10	Attaining	
			Zinc (dissolved) µg/L	Varies (A&Ww)	2,500 - 56,000	10 of 10	Impaired	
			Zinc (total) µg/L	22,000 - FC 25,000 - AgL 42,000 - FBC	7,680 - 56,000	8 of 9 8 of 9 6 of 9	Inconclusive	
Cienega Creek headwaters-Interstate 10 AZ15050302-006A A&Ww, FC, FBC, AgL	ADEQ Stream Ecosystem Monitoring Below Stevenson Canyon SCCIE012.38 100601	1998 - 1 suite	OK					Missing core parameter: E. coli.
	ADEQ Biocriteria Program Above the Narrows SCCIE012.55 100480	1998 - 1 suite	OK					Missing core parameter: E. coli.
	ADEQ Stream Ecosystem Below Tilted Beds SCCIE011.80 100600	1998 - 1 suite	OK					Missing core parameter: E. coli.

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	Summary Row	1998	OK				Inconclusive	ADEQ collected samples at 3 sites in 1998. Reach is assessed as "inconclusive" and will be added to Planning List due to a lack of sampling events, seasonal coverage, and no bacteria samples.
	A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	3 samples 1 sampling event Missing a core parameter						
Cienega Creek Interstate 10-Del Lago Dam AZ15050302-006B A&Ww, FBC, FC, AgL	ADEQ Stream Ecosystem Monitoring Above Diversion Dam SCCIE000.42 100595	1998 - 1 suite	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	4.6 (54% saturation)	1 of 1		Staff documented that low dissolved oxygen was due to ground water upwelling that is naturally low in dissolved oxygen; therefore, not considered in the final assessment. Missing core parameter: E. coli.
	ADEQ Stream Ecosystem Monitoring At Marsh Station Road SCCIE001.07 100263	1998 - 1 suite	Ok					Missing core parameter: E. coli.
	ADEQ Stream Ecosystem Monitoring Above Davidson Canyon SCCIE001.20 100598	1998 - 1 suite	Dissolved oxygen mg/l	6.0 (90% saturation)	5.4	1 of 1		Staff documented that low dissolved oxygen was due to ground water upwelling that is naturally low in dissolved oxygen; therefore, not considered in the final assessment. Missing core parameter: E. coli.
	ADEQ Stream Ecosystem Monitoring Below tilted beds SCCIE003.5 100599	1998 - 1 suite	Ok					Missing core parameter: E. coli.
	Summary Row	1998	OK				Inconclusive	ADEQ collected samples at 4 sites in 1998. Reach is assessed as "inconclusive" and will be added to the Planning List due to insufficient sampling events, seasonal coverage, and lack of bacteria samples.
	A&Ww Inconclusive FC Inconclusive FBC Inconclusive AgL Inconclusive	4 samples 1 sampling event Missing a core parameter						
Cox Gulch headwaters-Three R Canyon AZ15050301-560 A&Ww, FBC, FC, AgL	ADEQ TMDL Monitoring Below Cox Gulch and canyon leading to European Mine SCCXG000.85 100869	1999 - 1 pH, total/dissolved beryllium, cadmium, copper, zinc 2000 - 1 pH, total/dissolved beryllium, cadmium, copper, zinc	Copper (dissolved) µg/L	49-65 (A&Ww)	8200 - 18,000	2 of 2		
			Cadmium (total) µg/L	41 - FC 70 - FBC	35 - 72	1 of 2 1 of 2		
			Beryllium (total) µg/L	0.21 (FC)	8 - 12	2 of 2		
			pH SU	6.5 - 9.0 (A&Ww, FBC)	3.3	1 of 1		
			Zinc (dissolved) µg/L	290-379 (A&Ww)	3200 - 11,000	2 of 2		

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	ADEQ TMDL Monitoring At European Mine canyon SCCXG001.02 100875	1999 - 1 total/dissolved beryllium, cadmium, copper, zinc	Copper (dissolved) µg/L	44 (A&Ww)	7600	1 of 1		
			Zinc (dissolved) µg/L	264 (A&Ww)	2900	1 of 1		
			Beryllium (total) µg/L	0.21 (FC)	7.4	1 of 1		
	ADEQ TMDL Monitoring Above European Mine canyon SCCXG001.04 100876	1999 - 1 total/dissolved beryllium, cadmium, copper, zinc	Copper (dissolved) µg/L	65 (A&Ww)	8000	1 of 1		
			Zinc (dissolved) µg/L	379 (A&Ww)	5900	1 of 1		
			Beryllium (total) µg/L	0.21 (FC)	7.4	1 of 1		
	Summary Row A&Ww Impaired FC Inconclusive FBC Inconclusive AgL Inconclusive	1999-2000 4 samples 2 sampling events Missing core parameters	Copper (dissolved) µg/L	Varies (A&Ww)	8200 - 16,000	4 of 4	Impaired	ADEQ collected 4 samples at 3 sites from 1999 - 2000. Reach assessed as impaired due to dissolved metals. Reach also added to the Planning List due to total metals, pH, and missing core parameters. Impairment will be addressed through the Three R Canyon TMDL in progress.
			Cadmium (total) µg/L	41 - FC 70 - FBC	35 - 72	1 of 4	Inconclusive	
			Beryllium (total) µg/L	0.21 (FC)	7.4 - 12	4 of 4	Inconclusive	
			pH SU	6.5 - 9.0 (low) (A&Ww, FBC)	3.3	1 of 4	Inconclusive	
			Zinc (dissolved) µg/L	Varies (A&Ww)	2,900 - 11,000	4 of 4	Impaired	
Endless Mine Tributary headwaters-Harshaw Creek AZ15050301-888 A&We, PBC	ADEQ TMDL Monitoring above Endless Chain Mine SCHRS000.38 100850	1999 - 1 field, total/dissolved copper & zinc	pH SU	6.5 - 9.0 (A&We, PBC)	6.2	1 of 1		
	ADEQ TMDL Monitoring above mine-impacted area SCHRS000.56 100851	1999 - 2 field, total/dissolved copper & zinc	Dissolved oxygen mg/L	6 (90% saturation) (A&Ww)	5.7 - 6.94 (75 - 94% saturation)	1 of 2		Staff documented that low dissolved oxygen was due to ground water upwelling that is naturally low in dissolved oxygen; therefore, not considered in the final assessment.
			pH SU	8.5 - 9.0 (A&We, PBC)	5.2 - 8.3	2 of 2		
	Summary Row A&We Inconclusive PBC Inconclusive	1998-1999 3 samples 2 sampling events Missing core parameters	pH SU	6.5 - 9.0 (A&We, PBC)	5.2-8.3	3 of 3	Inconclusive	ADEQ collected 3 samples at 2 sites from 1998 - 1999. Reach should be added to the Planning List due to low pH and missing core parameters.

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Harshaw Creek headwaters-ephemeral seg. AZ15050301-025A A&Ww, FC, FBC, AgL	ADEQ TMDL Monitoring Below Trench Camp Mine SCHRS011.56 100319	1998 - 4 nutrients, total/dissolved copper, zinc	Copper (total) µg/L	500 (AgL)	16 - 620	1 of 4		
			Zinc (dissolved) µg/L	varies (A&Ww)	170 - 860	3 of 4		
	ADEQ TMDL Monitoring At lowest observed water SCHRS003.0 100318	1998 - 4 nutrients, total/dissolved copper, zinc	OK					
	ADEQ TMDL Monitoring Below Endless Chain Mine Cyn SCHRS013.63 100848	1999 - 1 field, total/dissolved copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC, AgL)	4.6	1 of 1		
			Copper (dissolved) µg/L	10 (A&Ww)	62	1 of 1		
			Zinc (dissolved) µg/L	73 (A&Ww)	190	1 of 1		
	Summary Row A&Ww Impaired FC Inconclusive FBC Inconclusive AgL Inconclusive	1998-1999	Copper (total) µg/L	500 (AgL)	16 - 620	1 of 9	Inconclusive	ADEQ collected 9 samples at three sites from 1998 - 1999. Reach is assessed as impaired due to dissolved zinc. Reach should be added to the Planning List due to copper, low pH, and missing core parameters.
		9 samples 5 sampling events	Copper (dissolved) µg/L	Varies (A&Ww)	10 - 62	1 of 9	Inconclusive	
		Missing core parameters	pH SU	6.5 - 9.0 (low) (A&Ww, FBC, AgL)	4.6 - 6.3	1 of 9	Inconclusive	
			Zinc (dissolved) µg/L	Varies (A&Ww)	42 - 860	4 of 9	Impaired	
Humboldt Canyon headwaters-Alum Gulch AZ15050301-340 A&Ww, FBC, FC, AgL	ADEQ TMDL Monitoring Lower Humboldt Canyon at base of falls, above Humboldt SCHMC001.27 100840	1999 - 1 field, total/dissolved cadmium, copper, and zinc	pH SU	6.5-9.0 (A&Ww, FBC, AgL)	3.6	1 of 1		
			Copper (dissolved) µg/L	4 (A&Ww)	140	1 of 1		
			Zinc (dissolved) µg/L	30 (A&Ww)	85	1 of 1		
	ADEQ TMDL Monitoring Upper Humboldt Canyon, At Jeep Road SCHMC002.41 100841	1999 - 1 field, total/dissolved cadmium, copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC, AgL)	3.3	1 of 1		
			Copper (dissolved) µg/L	7 (A&Ww)	540	1 of 1		
			Copper (total) µg/L	500 (AgL)	550	1 of 1		
			Zinc (dissolved) µg/L	49 (A&Ww)	210	1 of 1		

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID		YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
				PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row		1998	pH SU	6.5 - 9.0 (low) (A&Ww, FBC, AgL)	3.3 - 3.6	2 of 2	Inconclusive	Insufficient sampling events to assess. Add to Planning List.
	A&Ww	Inconclusive	2 samples 1 sampling event Missing core parameters	Copper (dissolved) µg/L	Varies (A&Ww)	140 - 540	2 of 2	Inconclusive	
	FC	Inconclusive		Copper (total) µg/L	500 (AgL)	160 - 550	1 of 2	Inconclusive	
	FBC	Inconclusive		Zinc (dissolved) µg/L	48 (A&Ww)	85 - 210	2 of 2	Inconclusive	
Nogales and E. Nogales Wash Mexico border-Santa Cruz River AZ15050301-011 A&Ww, PBC	ADEQ Fixed Station Network At West Produce Row Bridge SCNGW001.7 100697		1998 - 1 total chlorine	Chlorine µg/L	11	50	1 of 1		
	ADEQ Fixed Station Network At East Calle Sonora Road SCNGW002.6 100699		1998 - 1 total chlorine	Chlorine µg/L	11	140	1 of 1		
	ADEQ Stream Ecosystem Monitoring Near public works building SCNGW003.15 100206		1998 - 1 suite (no bacterial samples)	Chlorine µg/L	11	140	1 of 1		
	ADEQ Fixed Station Network At West Produce Row Bridge SCNGW003.4 100700		1998 - 1 total chlorine	Chlorine µg/L	11	300	1 of 1		
	ADEQ Fixed Station Network At West Produce Row Bridge SCNGW003.8 100701		1996 - 1 total chlorine	Chlorine µg/L	11	380	1 of 1		
	ADEQ Fixed Station Network At Morley Street Tunnel SCNGW004.23 100251		1996 - 5 suites 1997 - 4 suites 1998 - 5 suites 1999 - 4 suites 2000 - 4 suites	Ammonia mg/l	varies (7.8) (A&Ww)	<0.1 - 9.0	1 of 20		
				Arsenic µg/L	50 (PBC)	<10 - 65	1 of 22		
				Chlorine (free) µg/L	11 (A&Ww)	70 - 2830	21 of 21		
				Dissolved oxygen mg/L	6 (90% saturation) (A&Ww)	4.4 - 9.6 (62%-108% saturation)	3 of 21		
				Fecal coliform CFU/100 ml	4000 (A&Ww, PBC)	0 - >1,000,000	3 of 16		

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
			Turbidity NTU	50 (A&Ww)	1.51 - 2730	5 of 22		
	Summary Row	1996 - 2000	Ammonia mg/l	varies (7.8) (A&Ww)	<0.1 - 9.0	1 of 21	Attaining	ADEQ collected 27 samples at 6 sites from 1996 - 2000. Reach assessed as "impaired" due to chlorine, fecal coliform, and turbidity. Deteriorated wastewater treatment infrastructure in Mexico has resulted in increased levels of fecal coliform and, consequently chlorine has been added directly to the stream at high levels to minimize public health concerns.
	A&Ww PBC	27 samples 24 sampling events	Arsenic µg/L	50 (PBC)	<10-65	1 of 23	Attaining	
			Chlorine (free) µg/L	11 (A&Ww)	70 - 2830	26 of 26	Impaired	
			Dissolved oxygen mg/L	6 (90% saturation) (A&Ww)	4.4 - 9.6 (62% - 106% saturation)	3 of 22	Attaining	
			Fecal coliform CFU/100 ml	4000 (A&Ww, PBC)	0 - >1,000,000	3 of 16 4 in 3 years	Impaired	
			Turbidity NTU	50 (A&Ww)	1.51 - 2730	5 of 23	Impaired	
Pena Blanca Canyon Creek Mexico bdr-Pena Blanca Lake AZ15050301-808 A&Ww, FBC, FC, AgL, AgI	AGFD Lakes Program At springs	1997 - 1 suite	OK					Missing core parameters: turbidity, flow, dissolved metals, bacteria, and boron.
	AGFD Lakes Program At International Border	1997 - 1 suite	OK					Missing core parameters: turbidity, flow, dissolved metals, bacteria, and boron
	Summary Row A&Ww Inconclusive FBC Inconclusive FC Inconclusive AgI Inconclusive AgL Inconclusive	1997 2 samples 1 sampling event Missing core parameters	OK				Inconclusive	AGFD collected 2 samples at two sites in 1997. Insufficient parametric coverage and sampling events to assess.
Potrero Creek Interstate19-Santa Cruz River AZ15050301-500B A&Ww, FC, FBC, AgL	ADEQ Fixed Station Network At Santa Cruz River SCPOT000.1 100702	1998 - 1 chlorine	Chlorine µg/l	11 (A&Ww)	80	1 of 1		
	ADEQ Stream Ecosystem Monitoring Upstream of treatment plant SCPOT000.72 100208	1998 - 1 suite	Chlorine µg/l	11 (A&Ww)	80	1 of 1		

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED – MONITORING DATA – 2002 ASSESSMENT

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	Friends of the Santa Cruz R. At Ruby Road SCPOT001.53 100571	1996 - 6 suites 1997 - 12 suites 1998 - 12 suites 1999 - 12 suites 2000 - 12 suites	Ammonia mg/L	Standards vary with temperature and pH. (A&Ww)	0.03 - 17.9	2 of 50		Missing core parameters: Escherichia coli, inorganics, or metals
			Dissolved oxygen mg/L	6 (90% saturation) (A&Ww)	0.5 - 14	5 of 25		
			Fecal coliform CFU/100 ml	4000 (A&Ww, AGL)	0 - 1,000,000	3 of 15		
			Turbidity NTU	50 (A&Ww)	0.9-220	2 of 27		
	ADEQ Stream Ecosystem Monitoring ½ mile N. of Fire Station B SCPOT003.38 100207	1998 - 1 suite	OK					Missing core parameters: bacteria
	ADEQ Fixed Station Network North of Nogales Fire Station SCPOT003.5 100705	1998 - 1 chlorine	Chlorine µg/l	11 (A&Ww)	30	1 of 1		
	Summary Row	1998 - 2000	Ammonia mg/L	Vary with pH and temp. (A&Ww)	0.03 - 17.9	2 of 52	Attaining	ADEQ and the Friends of the Santa Cruz River collected 59 samples at 6 sites from 1996 - 2000. Reach assessed as impaired due to fecal coliform. Reach should also be added to the Planning list due to chlorine exceedances, and lack of Escherichia coli samples. Chlorine added in Nogales Wash also affecting this segment (see note above).
	A&Ww Impaired	59 samples	Chlorine µg/l	11 (A&Ww)	40	3 of 3 (1 sampling event)	Inconclusive	
	FC Attaining	57 sampling events	Dissolved oxygen mg/L	6 (90% saturation) (A&Ww)	0.5 - 14	5 of 27	Attaining	
	FBC Attaining		Fecal coliform CFU/100 ml	4000 (A&Ww, AgL)	0 - 1,000,000	3 of 17 3 in 2 years	Impaired	
	AgL Impaired		Turbidity NTU	50 (A&Ww)	0.9-220	2 of 27	Attaining	
Sabino Canyon Creek headwaters-Tanque Verde AZ15050302-014 A&Wc, FC, FBC, DWS, AgL	ADEQ Biocriteria Program Above East Fork Sabino Cyn. SCSAB007.56 100635	1996 - 1 suite	Dissolved oxygen mg/l	7.0 (90% saturation) (A&Wc)	4.0	1 of 1		Missing core parameters: bacteria
	Summary Row	1996	Dissolved oxygen mg/l	7.0 (90% saturation) (A&Wc)	4.0	1 of 1	Inconclusive	Assessed as "Inconclusive" and added to the Planning list due to dissolved oxygen not meeting standards, insufficient sampling events, and lack of bacteria samples.

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Santa Cruz River Mexican border-Nogales WWTP AZ15050301-010 A&Ww, FC, FBC, DWS, Agl, Agl	Friends of the Santa Cruz R. At Guavai Ranch SCSCR091.90 100246	1996 - 2 suites 1998 - 2 suites 1999 - 1 suite 2000 - 6 suites	Turbidity NTU	50 (A&Ww)	200	1 of 1		Missing core parameters: E coli, inorganics, metals
			Dissolved Oxygen mg/L	6 (90% saturation) (A&Ww)	4.3 - 10.1 (64.1 - 126.1% saturation)	2 of 6		Staff documented that low dissolved oxygen was due to ground water upwelling that is naturally low in dissolved oxygen; therefore, not considered in the final assessment.
	ADEQ Fixed Station Network At international boundary SCSCR097.28 100239	1996 - 2 suites 1997 - 2 suites 1998 - 4 suites 1999 - 4 suites 2000 - 4 suites	<i>Escherichia coli</i> CFU/100 ml	580 (FBC)	4 - 10,000	2 of 7		
			Fecal coliform CFU/100 ml	4000 (A&Ww, AgL, Agl, DWS)	8 - 11,200	2 of 7		
			Turbidity NTU	50 (A&Ww)	0.52 - 1854	1 of 8		High flow event.
			Beryllium µg/L	0.21 (FC)	3.3	1 of 1		6 other beryllium values not included because the Laboratory Reporting Limit was too high.
	Summary Row A&Ww Impaired FC Attaining FBC Impaired DWS Impaired Agl Impaired Agl Impaired	1996 - 2000 27 sampling events	<i>Escherichia coli</i> CFU/100 ml	580 (FBC)	4 - 10,000	2 of 7 2 in 2 years	Impaired	ADEQ and the Friends of the Santa Cruz River collected 27 samples at two sites from 1996 - 2000. Reach was assessed as "Impaired" due to bacteria contamination. Reach should also be added to the Planning List due to turbidity and beryllium exceedances.
			Fecal coliform CFU/100 ml	4000 (A&Ww, AgL, Agl, DWS)	8 - 11,200	2 of 10 2 in 2 years	Impaired	
			Turbidity NTU	50 (A&Ww)	0.52 - 1854	2 of 9	Inconclusive	
			Beryllium µg/L	0.21 (FC)	3.3	1 of 1	Inconclusive	
Santa Cruz River International WWTP-Josephine AZ15050301-009 A&Wedw, PBC, AgL	Friends of the Santa Cruz R. At Rio Rico SCSCR087.06 100238	1996 - 11 suites 1997 - 12 suites 1998 - 12 suites 1999 - 12 suites 2000 - 12 suites	Fecal coliform CFU	800 (A&Wedw, PBC, Agl)	0 - 7,700	7 of 37		Missing core parameters: metals
			Turbidity NTU	50 (A&Wedw)	0.4-150 (lab samples)	1 of 30		
	Summary Row A&Wedw Impaired PBC Impaired Agl Impaired	1996 - 2000 59 sampling events	Fecal coliform CFU	800 (A&Wedw, PBC, Agl)	0 - 7,700	7 of 37	Impaired	The Friends of the Santa Cruz River, under ADEQ's guidance, collected 69 samples from 1996 - 2000. Reach assessed as "Impaired" due to fecal coliform. Reach should also be added to the Planning List due to missing core parameters.
			Turbidity NTU	50 (A&Wedw)	0.4-150 (lab samples)	1 of 30	Attaining	

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED – MONITORING DATA – 2002 ASSESSMENT

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			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
Santa Cruz River Josephine-Tubac bridge AZ15050301-008A A&Wedw, PBC, AgL	Friends of the Santa Cruz R. At Santa Gertrudis Lane SCSCR080.50 100247	1996 - 11 suites 1997 - 12 suites 1998 - 12 suites 1999 - 12 suites 2000 - 12 suites	Fecal coliform CFU	800 (A&Wedw, PBC, AgL)	0 - 9,200	9 of 37		Missing core parameters: metals
			Turbidity NTU	50 (A&Wedw)	0.5-150 (lab samples)	6 of 31		
	Friends of the Santa Cruz R. At Tubac Bridge SCSCR077.06 100243	1996 - 3 suites 1997 - 3 suites	OK					
	Summary Row A&Wedw Impaired PBC Impaired AgL Impaired	1996 - 2000 59 sampling events 65 samples Missing core parameters	Fecal coliform CFU	800 (A&Wedw, PBC, AgL)	0 - 9,200	9 of 45 9 within 3 years	Impaired	The Friends of the Santa Cruz River, under ADEQ's guidance, collected 69 samples from 1996 - 2000. Reach assessed as "Impaired" due to fecal coliform and turbidity. Reach also added to the Planning List due to missing core parameters and investigate the extent of impairment due to turbidity.
			Turbidity	50 (A&Wedw)	0.4-150	6 of 37 6 of 31 at Gertrudis	Impaired	
Santa Cruz River Tubac bridge-Sopori Wash AZ15050301-008B A&We, PBC, AgL	Friends of the Santa Cruz R. North of Chavez Siding Road SCSCR081.34 100244	1996 - 11 suites 1997 - 12 suites 1998 - 12 suites 1999 - 12 suites 2000 - 12 suites	Fecal coliform CFU / 100 ml	800 (A&We, PBC, AgL)	5 - 76,000	6 of 37		Missing core parameters: metals
	Summary Row A&We Impaired PBC Impaired AgL Impaired	1996 - 2000 59 sampling events Missing core parameters	Fecal coliform CFU / 100 ml	800 (A&We, PBC, AgL)	5 - 76,000	6 of 43 6 within 3 years	Impaired	The Friends of the Santa Cruz River, under ADEQ's guidance, collected 43 samples at two sites from 1996 - 2000. Reach assessed as "Impaired" due to bacteria contamination.
Santa Cruz River Canada del Oro-Guild Wash AZ15050301-001 A&Wedw, PBC	USGS NAWQA Site #09486500 At Cortaro, AZ SCSCR029.16	1996 - 8 suites 1997 - 4 suites	Dissolved oxygen mg/l	3.0 (3 hours after sunrise to sunset) (A&Wedw)	2.0 - 3.7	6 of 12		Missing core parameters: fecal coliform
	Summary Row A&Wedw Inconclusive PBC Inconclusive	1996 - 1997 12 sampling events Missing core parameters	Dissolved oxygen mg/l	3.0 (3 hours after sunrise to sunset) (A&Wedw)	2.0 - 3.7	6 of 12	Inconclusive	USGS NAWQA Program collected 12 samples from 1996 - 1997. Reach is assessed as "Inconclusive" and should be added to the Planning List due to dissolved oxygen exceedances and missing core parameters.
Sonoita Creek headwaters- 1 km blw Hwy 82 AZ15050301-013A A&We, PBC, AgL	ADEQ TMDL Monitoring At Cottonwood Springs SCSON016.4 100321	1998 - 4 nitrogen, cadmium, copper, lead, zinc, arsenic, beryllium, and mercury.	OK					

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row	1998	OK				Inconclusive	ADEQ collected 4 samples in 1998. Reach assessed as "inconclusive" due to insufficient parametric coverage.
	A&Ww Inconclusive PBC Inconclusive AgL Inconclusive	4 sampling events Missing core parameters						
Sonoita Creek 750 ft below WWTP-Santa Cruz AZ15050301-013C A&Ww, FC, FBC, AgL, AgL	ADEQ TMDL Monitoring Above Temporal Mouth SCSON008.5 100320	1998 - 4 nitrogen, cadmium, copper, lead, zinc, arsenic, beryllium, and mercury.	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	5-7 (64 - 95% saturation)	1 of 4		Staff documented that low dissolved oxygen was due to ground water upwelling that is naturally low in dissolved oxygen; therefore, not considered in the final assessment.
	Summary Row	1998	OK				Inconclusive	ADEQ collected 4 samples in 1998. Reach assessed as "attaining some uses" and should be added to the Planning List due to missing of core parameters.
	A&Ww Inconclusive FC Attaining FBC Inconclusive AgL Inconclusive AgL Inconclusive	4 samples Missing core parameters						
Sycamore Canyon headwaters-Mexico border AZ15080200-002 A&Ww, FC, FBC, AgL	ADEQ Biocriteria Program Above Penasco Canyon RMSYC002.33 100660	1998 - 1 field, ammonia, cadmium, copper, arsenic, thallium, and mercury	OK					
	Summary Row	1998 1 sampling event	OK				Not assessed	Insufficient parametric coverage and sampling events to assess.
Unnamed trib to Three R Cyn. headwaters-Three R Canyon AZ15050301-xxx A&Ww, FC, FBC	ADEQ TMDL Monitoring U/S from 3R Mine - South trib. (background) SCTHC004.50 100852	1999 - 1 field, beryllium, cadmium, copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC)	3.7	1 of 1		
			Copper (dissolved) µg/L	5 (A&Ww)	380	1 of 1		
			Zinc (dissolved) µg/L	37 (A&Ww)	51	1 of 1		
	Summary Row	1999 1 sampling event	pH SU	6.5 - 9.0 (A&Ww, FBC)	3.7	1 of 1	Inconclusive	Insufficient parametric coverage and sampling events to assess. Add to Planning List due to exceedances.
	A&Ww Inconclusive FC Inconclusive FBC Inconclusive		Copper (dissolved) µg/L	5 (A&Ww)	380	1 of 1		
			Zinc (dissolved) µg/L	37 (A&Ww)	51	1 of 1		
Three R Canyon headwaters-end of perennial flow AZ15050301-558A A&Ww, FC, FBC	ADEQ TMDL Monitoring At mouth of Cox Gulch SCTH003.03 100322	1998 - 2 field, beryllium, cadmium, copper, zinc	Copper (dissolved) µg/L	varies A&Ww	12,500-36,200	2 of 2		No pH readings.
			Beryllium µg/L	0.21 (FC) 4.0 (FBC)	8	1 of 1		

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					COMMENTS
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	
	ADEQ TMDL Monitoring Above 3R Min SCTHC004.67 100874	1999 - 1 field, beryllium cadmium, copper, zinc	Zinc (dissolved) µg/L	varies A&Ww	14,800-34,500	2 of 2		
			Copper (dissolved) µg/L	varies (6) (A&Ww)	1400	1 of 1		
			pH SU	6.5 - 9.0 (A&Ww, FBC)	3.8	1 of 1		
	ADEQ TMDL Monitoring Below uppermost springs in 3R Canyon and 3R Mine SCTHC004.01 100872	1998 - 4 field, beryllium cadmium, copper, zinc 1999 - 1 field, beryllium cadmium, copper, zinc 2000 - 1 field, beryllium cadmium, copper, zinc	Beryllium (total) µg/L	0.21 (FC) 4 (FBC)	2.4 - 5.1	2 of 2 (FC) 1 of 6 (FBC)		Other beryllium samples not used because Laboratory Reporting Limit was too high.
			Cadmium (total) µg/L	70 (FBC)	40 - 112	1 of 6		
			Cadmium(dissolved) µg/L	Varies (A&Ww)	35 - 143	6 of 6		
			Copper (dissolved) µg/L	Varies (A&Ww)	44,000 - 80,900	6 of 6		
			pH SU	6.5 - 9.0 (A&Ww, FBC)	2.9 - 3.1	5 of 5		
			Zinc (dissolved) µg/L	Varies (A&Ww)	850 - 2790	6 of 6		
	ADEQ TMDL Monitoring Above uppermost springs in 3R Canyon, Below 3R Mine SCTHC004.07 100949	1999 - 1 field, beryllium cadmium, copper, zinc	pH SU	6.5 - 9.0 (A&Ww, FBC)	3.5	1 of 1		
			Copper (dissolved) µg/L	5 (A&Ww)	7200	1 of 1		
			Zinc (dissolved) µg/L	37 (A&Ww)	110	1 of 1		
	Summary Row A&Ww Impaired FC Inconclusive FBC Inconclusive	1999 10 samples 6 sampling events Missing core parameters	Beryllium (total) µg/L	0.21 (FC) 4 (FBC)	<0.5 - 8	3 of 3 (FC) 2 of 10 (FBC)	Inconclusive	ADEQ collected 9 samples at 4 sites in 1999. Reach assessed as "Impaired" due to cadmium, copper and zinc. Reach is also added to the Planning List due to beryllium and low pH and missing core parameters.
			Cadmium (total) µg/L	70 (FBC)	40 - 112	1 of 10	Attaining	
			Cadmium (dis.) µg/L	Varies (A&Ww)	35 - 143	6 of 10	Impaired	
			Copper (dissolved) µg/L	Varies (A&Ww)	380 - 89,000	10 of 10	Impaired	
			pH SU	6.5 - 9.0 (low) (A&Ww, FBC)	2.9 - 3.1	7 of 7	Inconclusive	
			Zinc (dissolved) µg/L	Varies (A&Ww)	850 - 2790	9 of 10	Impaired	

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
LAKE MONITORING DATA								
Arivaca Lake AZL15050304-0080 A&Ww, FC, FBC, Agl, AgL	EPA TMDL Investigation SCARI	1998 - 2 suites, 2 sediment, 2 fish	pH SU	6.5-9.0 (A&Ww, FBC, Agl, Agl)	6.5 - 9.5	2 of 2		Sediment and fish tissue criteria not available for assessments. Missing core parameters: bacteria
	ADEQ Lakes Program SCARI 100000	1998 - 4 suites, 1 sediment	pH SU	6.5-9.0 (A&Ww, FBC, Agl, Agl)	6.3 - 9.5	1 of 4		
			Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	1.8 - 12.9	1 of 4		
	AGFD Lakes Program SCARI	2000 - 1 suite	OK					
	Summary Row	1998	pH (high) SU	6.5-9.0 (A&Ww, FBC, Agl, Agl)	6.3 - 9.5	3 of 7	Inconclusive	ADEQ, AGFD, and EPA collected samples from 1998 - 2000. Lake was assessed as "not attaining" because of a mercury TMDL approved by EPA in 2000. Reach added to Planning List to determine the effectiveness of TMDL strategies, exceedances of pH and dissolved oxygen standards, and missing core parameters.
	A&Ww Inconclusive FC Not attaining FBC Inconclusive Agl Inconclusive Agl Inconclusive	2 sediment samples 2 fish tissue samples 7 water samples 5 sampling events Missing core parameters	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	1.8 - 12.9	1 of 7	Inconclusive	
Kennedy Lake AZL15050301-0720 A&Ww, FC, PBC	ADEQ/AGFD Urban Lakes Study SCKEN 100028	1998 - 10 suites 1999 - 2 suites	pH (high)	6.5-9.0 (A&Ww, PBC)	7.9 - 9.3	1 of 12		Missing core parameters: bacteria
	AGFD Routine Monitoring up to 3 sites SCKEN	1997 - 1 suite	OK					Missing core parameters: depth, metals, bacteria, and turbidity.
	Summary Row	1997 - 1999	pH (high)	6.5-9.0 (A&Ww, PBC)	7.9 - 9.3	1 of 13	Attaining	ADEQ and AGFD collected 13 samples from 1997 - 1999. Lake is assessed as "attaining some uses" and added to the Planning List due to missing bacteria samples.
Lakeside Lake AZL15050302-0760 A&Ww, FC, PBC	AGFD Routine Monitoring SCLAK	1997 - 1 suite 1998 - 1 suite	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	0.9 - 1.7 (18%-176%)	2 of 2		Missing core parameters: metals, bacteria
	ADEQ/AGFD Urban Lake Study SCLAK 100034	1998 - 12 suites 1999 - 2 suites	pH SU	6.5-9.0 (A&Ww, PBC)	7.3 - 9.8	2 of 14		Missing core parameters: bacteria
			Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	1.5 - 17.1 (18%-176%)	2 of 14		
	Summary Row	1997 - 1999	pH SU	6.5-9.0 (A&Ww, PBC)	7.3 - 9.8	2 of 16	Attaining	ADEQ and AGFD collected 16 samples from 1997 - 1999. Lake is assessed as "attaining some uses" and added to the Planning list due to dissolved oxygen exceedances and missing core parametric coverage.
	A&Ww Inconclusive FC Attaining PBC Inconclusive	16 sampling events Missing core parameters	Dissolved oxygen mg/l	6.0 (90% saturation) (A&Ww)	1.5 - 17.1 (18%-176%)	4 of 16	Inconclusive	

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED – MONITORING DATA – 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
Parker Canyon Lake AZL15050301-1040 A&Wc, FC, FBC, Agl, AgL	ADEQ Lakes Program SCPAK 100057	1998 - 3 suites	OK					Missing core parameters: bacteria
	Summary Row A&Wc Attaining FC Attaining FBC Inconclusive Agl Attaining AgL Attaining	1998 3 sampling events Missing bacteria samples.	OK				Attaining	ADEQ collected 3 samples in 1998. Lake assessed as "attaining some uses" and added to the Planning List due to missing core parameters.
Patagonia Lake AZL15050301-1050 A&Wc, FC, FBC, DWS, Agl, AgL	EPA TMDL SCPAT	1998 - 1 suite	Dissolved oxygen mg/l	7.0 (90% saturation)	6.5 - 6.7	1 of 1		Missing core parameters: bacteria.
	ADEQ Lakes Program SCPAT	1998 - 3 suites	OK					Missing core parameters: bacteria.
	Summary Row A&Wc Inconclusive FC Attaining FBC Inconclusive DWS Attaining Agl Attaining AgL Attaining	1998 4 samples 3 sampling events	Dissolved oxygen mg/l	7.0 (90% saturation)	6.5 - 6.7	1 of 4	Inconclusive	ADEQ and EPA collected 4 samples in 1998. Lake assessed as "attaining some uses" and added to the Planning List due to missing bacteria samples.
Pena Blanca Lake AZL15050301-1070 A&Wc, FC, FBC, Agl, AgL	EPA TMDL Investigation SCPEN	1998 - 1 suite, sediment	OK					No sediment criteria available for assessments. Missing core parameters: bacteria.
	ADEQ Lakes Program SCPEN 100064	1998 - 3 suites	pH (low) SU	6.5-9.0 (A&Ww, FBC, AgL)	6.1 - 8.2	2 of 3		Missing core parameters: bacteria.
	Summary Row A&Wc Inconclusive FC Not attaining FBC Inconclusive Agl Attaining AgL Inconclusive	1998 1 sediment sample 4 water samples 4 sampling events Missing core parameters.	pH (low) SU	6.5-9.0 (A&Ww, FBC, AgL)	6.1 - 8.2	2 of 3	Inconclusive	ADEQ and EPA collected 4 samples in 1998. Lake assessed as "not attaining" because of a fish consumption advisory due to mercury in fish tissue, and the completion and approval of a mercury TMDL in 2000. Lake is added to the Planning List for TMDL effectiveness monitoring and due to missing core parameters.
Rose Canyon Lake AZL15050302-1260 A&Wc, FC, FBC, Agl, AgL	ADEQ Lakes Program SCROS 100183	1998 - 1 suite	pH SU	6.5-9.0 (A&Ww, FBC, Agl, AgL)	6.2 - 9.2	1 of 1		
			Turbidity NTU	50 (A&Ww)	4.6 - 19	1 of 1		

TABLE 25. SANTA CRUZ-RIO MAGDALENA-RIO SONOYTA WATERSHED -- MONITORING DATA -- 2002 ASSESSMENT

STREAM NAME SEGMENT WATERBODY ID DESIGNATED USES	AGENCY PROGRAM SITE DESCRIPTION SITE CODE ADEQ DATABASE ID	YEAR SAMPLED NUMBER AND TYPE OF SAMPLES	STANDARDS EXCEEDED AT THIS SITE PER SAMPLING EVENT					
			PARAMETER UNITS	STANDARD (DESIGNATED USE)	RANGE OF RESULTS (MEAN)	FREQUENCY EXCEEDED STANDARD	DESIGNATED USE SUPPORT	COMMENTS
	Summary Row	1998	pH SU	6.5-9.0 (A&Ww, FBC)	6.2 - 9.2	1 of 1	Inconclusive	Lake assessed as "Inconclusive" and added to the Planning List due to pH and turbidity exceedances and insufficient sampling events.
	A&Wc Inconclusive FC Inconclusive FBC Inconclusive AgI Inconclusive AgL Inconclusive	1 sampling event	Turbidity NTU	50 (A&Ww)	4.6 - 19	1 of 1		

Information for interpreting these Monitoring Tables

- "Segment" designates the beginning and end points of the reach.
- "Waterbody ID" is derived from combining the following: AZ (for streams) or AZL (for lakes) + a US Geological Survey Hydrologic Unit Code + EPA stream reach number or ADEQ lake number.
- "Designated Uses," "Agency," and "Units" (of measurement) abbreviations are defined in Appendix A.
- "Site Code" is an ADEQ derived abbreviation for the surface water basin, stream name or lake name, and the location of the site. For streams, the numbers are the miles upstream from mouth (normally measured as a straight line vector).
- "ADEQ Database ID" -- This is ADEQ's water quality database reference number. If the data is not in this database, no number will be shown.
- "Samples" -- The year and number of water samples is shown. The federal "water year" is used, from October 1st through September 30th, rather than the calendar year. Types of samples:
 - "Suite" indicates that a broad range of chemical constituents were collected and field measurements were taken (normally inorganics, metals, nutrients, and bacteria). The chemical constituents monitored are not consistent among the many monitoring entities that provided the data. If the suite did not include the core parameters needed to assess a designated use as "attaining," the missing core parameters are indicated.
 - "Field" indicates that only field measurements such as dissolved oxygen, pH, turbidity, and water temperature were collected.
 - If a specific parameter or parametric group (e.g., zinc, metals, bacteria) is named, monitoring was limited to only these parameters.
- "Standards Exceeded at this Site per Sampling Event."
 - Although many parameters may be analyzed, only those exceeding a standard are shown. Other parameters were collected.
 - "OK" indicates that no standards were exceeded.
 - The specific standards are shown as a single parameter may have multiple standards depending on the designated uses assigned. (See standards in Appendix C.)
 - "The Range of Results" indicates the minimum and maximum sample results. If the laboratory reported result is "less than the detection limit" or "not detected," a less than (<) value will be shown along with the detection limit (e.g., <0.5 mg/L).
 - A mean, geometric mean, or median will be shown along with the range of results if applicable to the standard or assessment criteria.
- "Comments" include other information used in interpreting the data for assessments, such as evidence that exceedance is solely due to natural conditions, or that the data does not meet the new "credible" data requirements.
- In the "Summary Row" parameter exceedances are combined from multiple sites, and the assessment of each designated use is shown. The overall assessment for the surface water is described in the "Comments" field: "Attaining," "Not attaining," "Impaired," or "Inconclusive." See assessment criteria in Chapter III of Volume I.

Ground Water Assessments in the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed

Major Ground Water Stressors -- Monitoring data collected from wells in this watershed between October 1995-October 2000 are summarized in **Table 26** and illustrated in **Figures 48, 49, and 50**.

Overall, nitrates appear to be the most common contaminant affecting ground water quality in the greater Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed. Some probable sources of nitrate in ground water in this watershed would be historic agricultural application of fertilizers and wastewater disposal practices.

Although only three wells exceeded volatile and semi-volatile organic compounds standards, it is important to note that no standards have been established for many of these human-made pollutants, and 12 other wells detected volatile and semi-volatile organic chemicals (VOCs and SVOCs). Contamination sites in the Tucson and Nogales areas are being addressed under the state and federal Superfund programs and through international monitoring programs established with Mexico. Studies related to these sites are discussed in the next section of this watershed report.

Of approximately 89 wells monitored, very few other standards were exceeded (1 radiochemical, 2 fluoride, 1 metal). **Figure 48** illustrates the location of the wells monitored and the wells exceeding standards.

TDS Concentrations -- Water quality can be characterized based on concentration of Total Dissolved Solids (TDS). High levels of salinity limits the practical uses of ground water in some areas of this watershed as TDS over 500 mg/L has an off-flavor (23% of wells monitored), and TDS over 1000 mg/L will limit its use for some crops (7% of wells monitored) (**Figure 49 and Table 26**).

No TDS water quality standards apply in this watershed and the elevated levels of TDS do not present a human-health concern for drinking water. The TDS concentration is only used to generally characterize water quality.

Nitrate Concentrations -- Water quality can also be characterized by looking at the concentration of nitrates in ground water. In Arizona, natural occurring nitrate concentrations in ground water are generally below 3 mg/L and concentrations above 5 mg/L may indicate potential anthropogenic sources of nitrates. Nitrates were elevated above 5 mg/L in 21 of the 85 wells sampled (25%). As illustrated in **Figure 50**, elevated nitrates are scattered across the

watershed.

When nitrate concentrations exceed 10 mg/L, an Arizona's Aquifer Water Quality Standard has been exceeded. This standard was set to protect human health, as water with nitrate greater than 10 mg/L may present a health problem for infants and should not be consumed by nursing mothers. Nine of the wells exceeded this level. As many of the wells sampled are irrigation wells (not used for drinking water), nitrates over 10 mg/L may not represent a human-health concern in this watershed. However, efforts should be made to minimize further contamination of ground water by nitrate.

Table 26. Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed Ground Water Monitoring 1996 - 2000

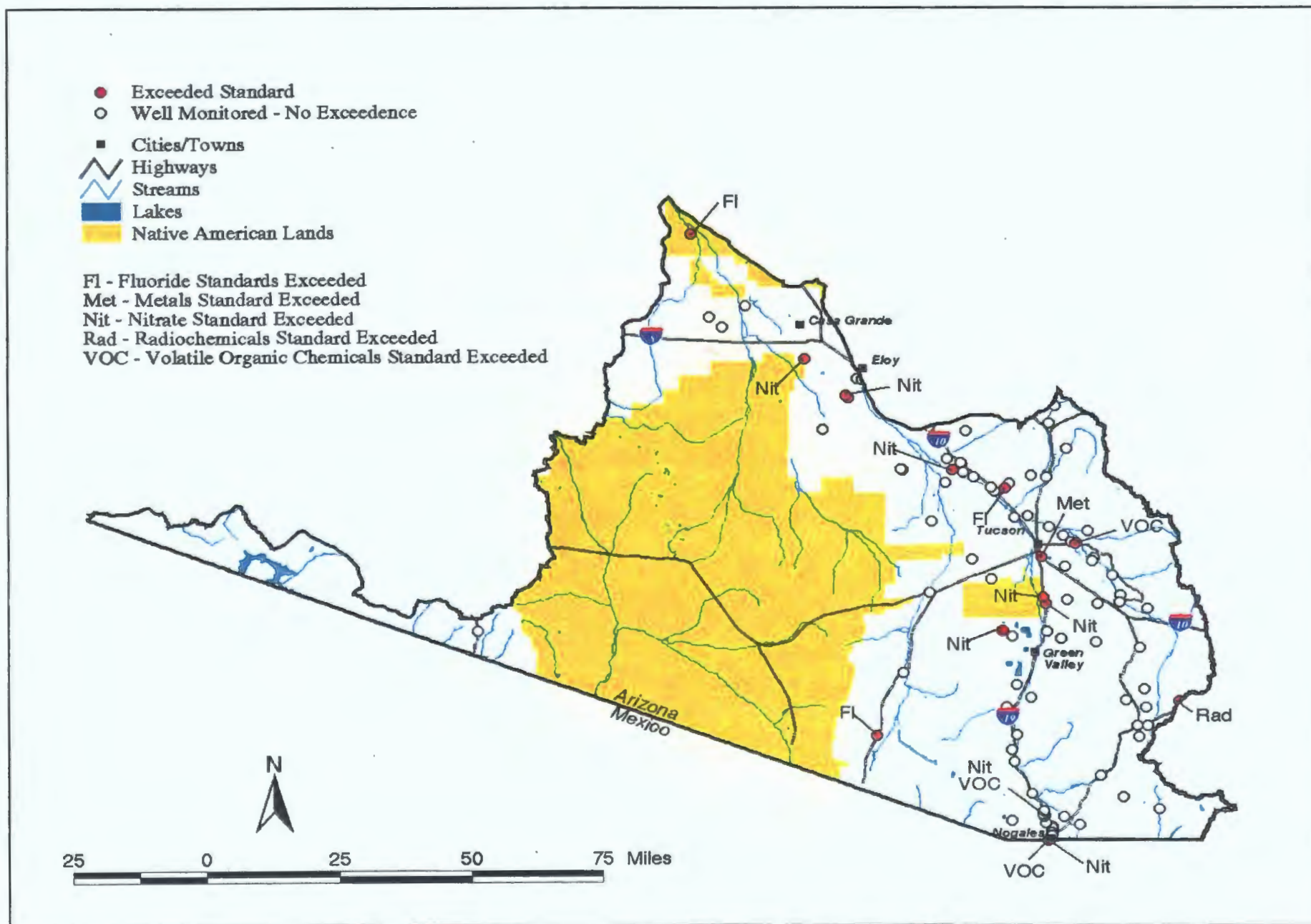
MONITORING DATA TYPE	PARAMETER OR PARAMETER GROUP	NUMBER OF WELLS			PERCENT OF WELLS EXCEEDING STANDARDS
		SAMPLED	SYNTHETIC CONSTITUENT DETECTED*	EXCEEDING STANDARDS	
INDEX WELLS	Radiochemicals	37		1	3%
	Fluoride	47		2	4%
	Metals/Metalloids	47		0	0%
	Nitrate	47		4	9%
	VOCs + SVOCs*	32	2	0	0%
	Pesticides	33	0	0	0%
TARGETED MONITORING WELLS	Radiochemicals	3		0	0%
	Fluoride	17		0	0%
	Metals/metalloids	42		1	2%
	Nitrate	38		5	13%
	VOCs + SVOCs*	32	10	3	9%
	Pesticides	25	1	0	0%

WELL CLASSIFICATION BY TOTAL DISSOLVED SOLIDS (TDS) CONCENTRATION				
Total Number of Wells	Wells <500 mg/L Acceptable drinking water flavor	Wells 500-999 mg/L Fresh (not saline) Some crop production problems	Wells 1000-3000 mg/L Slightly saline Increasing crop production problems	Wells >3000 mg/L Moderately saline to briny Severe crop production problems
55	43	11	1	0

WELL CLASSIFICATION BY NITRATE CONCENTRATION (measured as Nitrogen)			
Total Number of Wells	Wells <5 mg/L	Wells 5-10 mg/L May be an anthropogenic source of Nitrates	>10 mg/L Exceeds standards Should not be used for drinking water by babies or nursing mothers
85	64	12	9

*VOCs = volatile organic compounds; SVOCs = semi-volatile organic compounds.

*The detection of a synthetic constituent (pesticides, VOCs, and SVOCs) is noted because some do not have standards and these substances are not naturally occurring in the ground water.



48. Ground Water Monitoring in the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed – 1996-2000

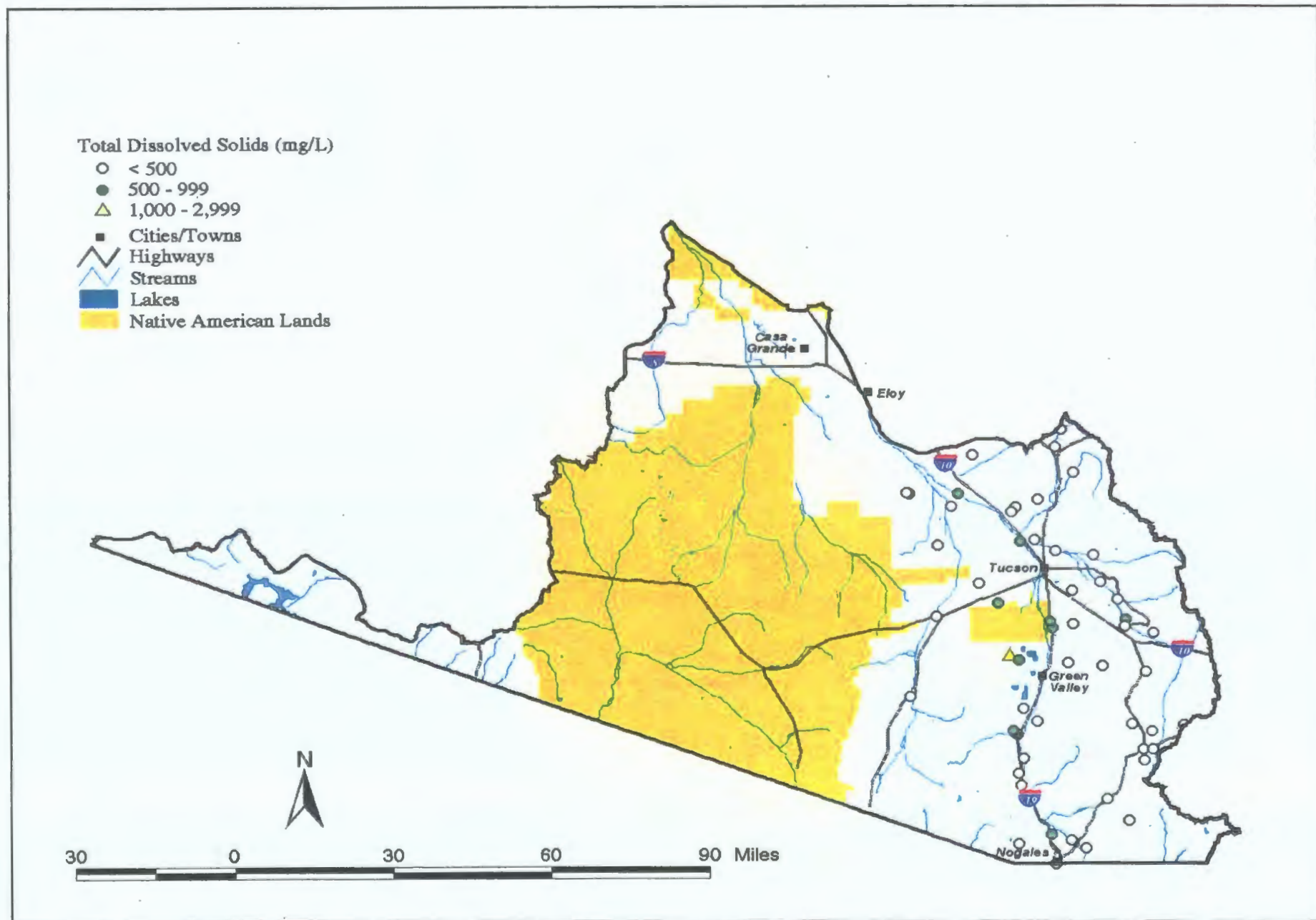


Figure 49. Classification of Ground Water Quality by TDS Concentration in the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed

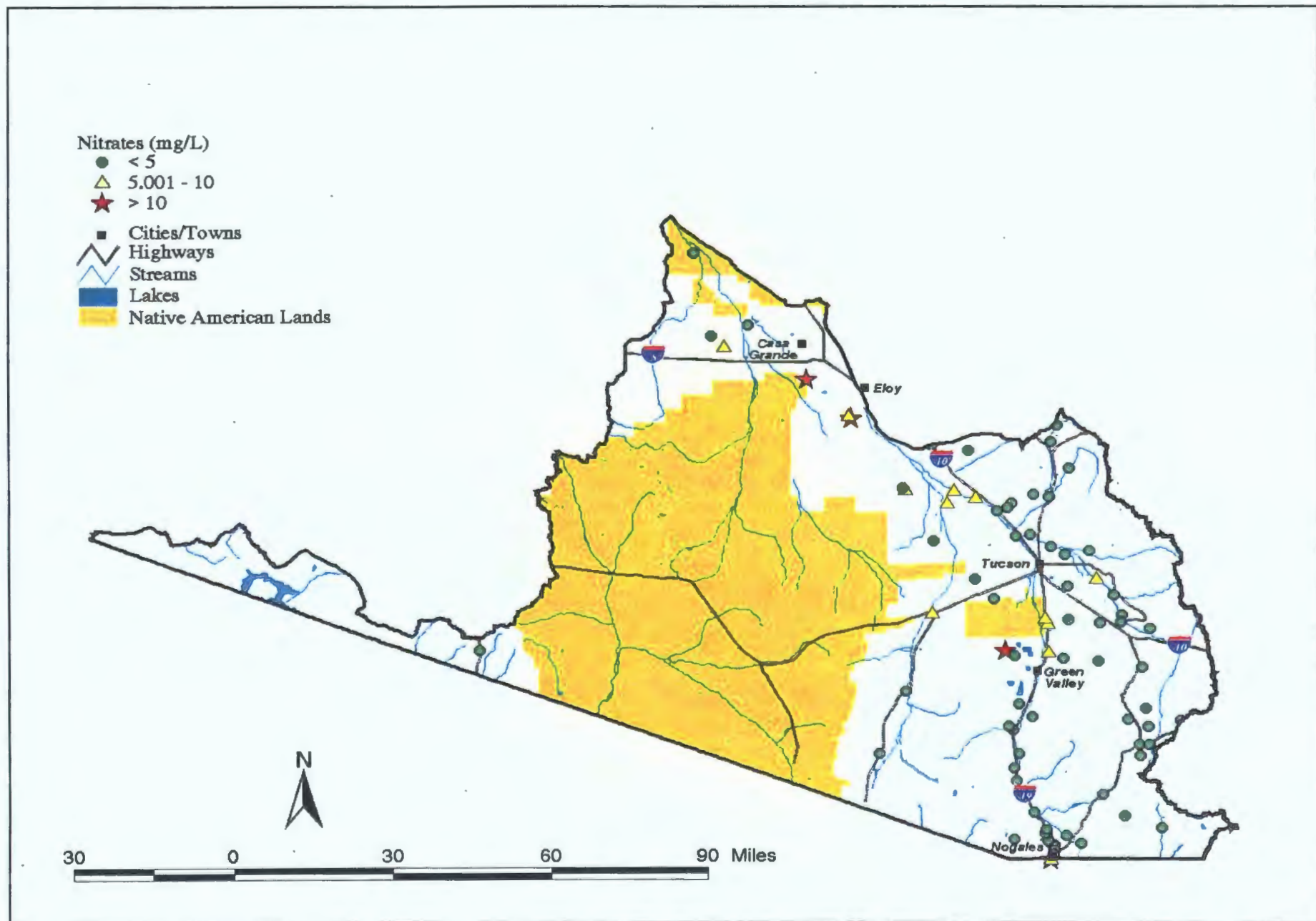


Figure 50. Classification of Ground Water Quality by Nitrate Concentrations in the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed

Watershed Studies and Alternative Solutions in the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed

Surface Water Studies and Mitigation Projects

This section highlights surface and ground water studies, mitigation projects, and remediation activities which have been conducted to improve water quality in the Santa Cruz-Rio Magdalena-Rio Sonoyta Watershed. Watershed partnerships active in this watershed are also mentioned.

Total Maximum Daily Load Analyses – The following TMDL analyses have been completed or are ongoing in this watershed. Further information about the status of these investigations can be obtained by contacting the TMDL Program manager at (602) 771-4468, or at ADEQ's web site:

<http://www.adeq.state.az.us/envirom/water/assess/tmdl.html>

- Arivaca Lake Mercury TMDL – Arivaca Lake was identified as impaired because mercury was elevated above EPA's guidance for fish consumption, resulting in a fish consumption advisory being issued. Water samples did not exceed surface water quality standards because mercury readily attaches to soil particles, plants, and fish tissue. Mercury is probably in the water but at a concentration below laboratory detection limits.

A TMDL for mercury in this lake was written for and approved by the U.S. Environmental Protection Agency in 1999 (Tetra Tech Inc, 1999). The TMDL analysis indicated that Arivaca Lake was receiving mercury simultaneously from multiple sources:

- ▶ Natural deposition from local substrates (mineral deposits);
- ▶ Atmospheric sources; and
- ▶ A dump site (potentially only a minor source of mercury).

This TMDL estimates that the loading capacity of Arivaca Lake is approximately 155 grams of mercury per year. A 38% reduction in background watershed loading of mercury will be needed to eventually reduce mercury burdens in fish tissue.

To meet this loading requirement within 10 years, the TMDL included the following provisions:

- ▶ Conduct a follow up watershed survey to identify any previously undetected mercury loading sources;
- ▶ Initiate remedial actions if any undetected sources are identified;
- ▶ Implement erosion control best management practices to mitigate further contamination by soils; and
- ▶ Monitor fish tissue for mercury levels to evaluate the effectiveness of any remediation actions.

- Pena Blanca Lake Mercury TMDL – Like Arivaca Lake, Pena Blanca Lake was impaired because of the presence of mercury in fish tissue in excess of EPA's Fish Consumption Guidelines, with a subsequent fish consumption advisory being issued. A TMDL was written for and approved by the U.S. Environmental Protection Agency in 1999 (Tetra Tech Inc, 1999). The TMDL analysis indicated that Pena Blanca Lake was receiving mercury from:

- ▶ Natural deposition from local substrates (mineral deposits);
- ▶ Atmospheric sources; and
- ▶ A contaminated mine tailings pile from St. Patrick Mine (potentially a significant source) on Coronado National Forest property.

The loading capacity of Pena Blanca Lake is approximately 145 grams of mercury per year. It is anticipated that the remediation of the contaminated mine tailings will reduce mercury loading into the lake to a level sufficient that the fish consumption advisory can be removed within 10 years. Fish tissue analysis will be needed to evaluate the effectiveness of the remediation and to determine if additional actions are necessary.

- Sonoita Basin Draft TMDLs (for Alum Gulch, Harshaw Creek, and Three-R Canyon) -- Draft TMDLs are being generated for three waterbodies in the Sonoita River drainage area: Alum Gulch, Harshaw Creek (Harshaw Wash), and Three-R Canyon. All three investigations are concerned with historic mining sites and acid mine drainage (low pH, high cadmium, copper, and zinc).

Currently, these TMDLs being revised based on public comment and new data provided by the US Geological Survey. Revised reports are to be released for further public comment in July 2002.

- Sonoita Creek Dissolved Oxygen TMDL Study – ADEQ's investigated sources contributing to low dissolved oxygen in Sonoita Creek in 1998 and determined that it was naturally occurring due to ground water upwelling. Ground water is naturally very low in dissolved oxygen. Based on this investigation, ADEQ is recommending that Sonoita Creek be removed from the 303(d) List in 2002.

US Geological Survey NAWQA Study – Samples were collected in this watershed as part of the US Geological Survey National Water Quality Assessment Program (NAWQA). This study included sites in the Middle Gila, Santa Cruz-Rio Magdalena-Rio Sonoyta, and Verde watersheds. (See statewide studies discussed in the beginning of Volume II.)

The US Fish and Wildlife Service Contaminant Studies – The USFWS has published the following three contaminant studies:

- Santa Cruz River Contaminant Study – To investigate the general decline of the endangered Gila topminnow, in 1997 the US Fish and Wildlife Service initiated an assessment of contaminant levels in water, sediment, invertebrates, fish, and birds in the Santa Cruz River (King, et al., 1999). Samples were collected from two sites upstream of the Nogales International Wastewater Treatment Plant and five sites downstream of that plant. Analytical results indicated that elevated chromium was present in both sediment, invertebrates, and fish. The study concluded that un-ionized ammonia was at levels toxic to fish at sites below the treatment plant discharge.
- Wastewater Treatment Plant Ponds in Nogales – Ducks collected from the Nogales International Wastewater Treatment Plant ponds in February 1996 contained low residues of organochlorine pesticides and polychlorinated biphenols (PCBs). Concentrations were below those known to adversely affect adult survival and reproduction. Elevated concentrations of mercury, possibly cadmium, chromium, and nickel were found in some ducks. The study concluded that the wastewater treatment plant discharge may be a source of elevated concentrations of these metals in the Santa Cruz ecosystem. However, the study noted

that untreated wastes from Mexico enter the Santa Cruz River just upstream of the treatment plant from Nogales Wash. Nogales Wash receives wastes from numerous border maquiladora industries and periodic storm flow events also flush contaminants from urban and industrial areas into the wash.

- Sonoran Mud Turtles from Quitobaquito Springs – The population of Sonoran mud turtles at Quitobaquito Springs in Organ pipe Cactus National Monument have drastically declined since the 1950s. The reason for the decline was largely attributed to inadequate food base, but analysis of tissue from eight dead turtles provided the opportunity to investigate whether organochlorine pesticides or heavy metals also played a role in their decline. Several metals and DDE were detected in the turtles, but the significance of these concentrations could not be determined and further investigations of related turtle species and the food supply at the spring ponds were recommended.

Water Protection Fund Projects – The following projects received Water Protection Funds from the Arizona Department of Water Resources:

- Partnership for Riparian Conservation – The Rincon Institute was awarded two grants to protect riparian areas along Tanque Verde Creek and Rincon Creek. **Phase I.** The Rincon Institute designed and implemented landowner-based strategies to identify and remediate damaged riparian areas and protect healthy ones. **Phase II.** The Rincon Institute will work with private landowners along Tanque Verde Creek and Rincon Creek on three separate projects to be completed in 2002:
 - ▶ Design a river-friendly erosion control structure that enhances riparian vegetation reestablishment. This is to stem the loss of property, encourage bank stabilization, and promote aggradation to enhance natural regeneration.
 - ▶ Restore riparian vegetation on two acres of former pasture land. Funding will be used for site characterization study, fencing, seed collection and propagation of revegetation materials, irrigation line construction, and site preparation and plantings.
 - ▶ Implement a long-term riparian conservation planning and public education project.

To complete Phase I in 1998, Rincon Institute partnered with personnel

from the Coronado National Forest, Saguaro National Park, University of Arizona, U.S. Geological Survey, developers and landowners in the watershed.

- Altar Valley Watershed Resources Assessment – Altar Valley Conservation Alliance received a grant to research historic conditions, describe existing conditions, conduct detailed vegetation mapping, and produce community outreach materials for the Altar Valley. The end product was an action plan for the restoration of this sub-watershed, identifying and prioritizing problems, describing feasible remedies, and identifying potential financial means of implement improvements. This project was completed in 2000.
- Madera Canyon - Proctor Vegetation Modification – The Coronado National Forest was awarded a grant to enhance the upland conditions along Madera Canyon. The project goal is to reduce the upland mesquite overstory (with minimal harm to other tree species) and to restore the herbaceous understory to a condition dominated by native perennial grass species. This project recognizes the importance of perennial grasses to soil stability and related in-stream reduction in turbidity. Perennial grasses can also encourage beneficial water retention and rain percolation into the ground, and increase litter development and organic matter levels within the soils.

Little perennial grass understory was at this site due to shading from excessive mesquite overstory. The project removed upland mesquite trees with main stem diameters less than 5 inches, temporary restricted vehicle use in the area, enforced livestock grazing guidelines, and refurbished a stock pond to draw cattle away from the treatment and regrowth site. The project was completed in 2001.
- Santa Cruz River Headwaters Project – The San Rafael Cattle Company received funds to restore and maintain seven miles of riparian and wetland corridor of the Santa Cruz River headwaters. Fences and water developments are to be constructed to control and manage livestock grazing in the riparian corridor. The project was completed in 2001.
- Oak Tree Gully Stabilization Project – Coronado National Forest was awarded funds to treat 30 headcuts in the Oak Tree Canyon and Empire Gulch (tributaries to Cienega Creek) by reshaping the gullies and

decreasing flow velocity and energy. The headcuts appear to be the result of forest service roads and unauthorized vehicular use and a source of turbidity in Cienega Creek. The project was completed in 2001.

- Cienega Creek fencing at Empire Ranch (Empire/Cienega/Empirita fencing project) – Empire Ranch was awarded Watershed Protection Funds to improve livestock management which will benefit the health of the Cienega Creek ecosystem. These improvements included: extending an existing fence, separating sacaton benches, creating a livestock enclosure for monitoring, realigning a degraded road, and creating an alternate wildlife and livestock water source. The project will be completed in 2002.
- Cienega Creek Restoration Project – The US Bureau of Land Management received funds to remove an unused agricultural diversion canal and re-establish flow through the Cienega Creek channel. Disturbed areas were revegetated using plants salvaged at the site. The project was completed in 1999.
- Cienega Creek Restoration Evaluation Project – ADEQ was awarded funds to survey Cienega Creek. Data generated at these sites will be used to better understand erosive processes of dryland streams, a significant problem throughout the state. The project is to be completed in June 2003.
- Lower Cienega Basin geological model refinement project – Arizona Geological Project refined the geologic model for the lower Cienega Basin, located southeast of Tucson. The geologic model is an important component of a computer model used to predict the impact of ground water pumping within a basin on perennial and intermittent stream flow. This research project was completed in 1996.
- Hay Mountain Watershed Rehabilitation – A private owner was awarded funds to install four miles of pipelines and three 10,000 gallon water storage tanks with drinkers, rip and seed native grasses, reshape and recontour two erosion sites, and to install a variety of flood control structures. These watershed improvements are designed to reduce flooding and erosion by increasing infiltration of rainfall into the soil. The project will be completed in 2002.

The grantee is working with the Natural Resource Conservation Service, the Arizona State Land Department, the Douglas Whitewater Draw Conservation District, Rocky Mountain Elk Foundation, and the Arizona Game and Fish Department to restore and rehabilitate the Hay Mountain sub-watershed (approximately 1000 acres) on the NI Ranch. This sub-watershed is located northwest of Douglas in the southeastern part of the state. The site suffers from over-grazing, with reduction of native grasses and subsequent increases in overland flow. The ephemeral streams have increased width-depth ratios, increased sediment transport and some gullying within the larger arroyos.

- Puertocito Wash Rehabilitation Project on the Buenos Aires National Refuge – The Arizona Conservation Voters Habitat Fund received funds to rehabilitate Puertocito Wash, an eroded ephemeral stream on the Buenos Aires National Refuge. Two gabions were constructed along the stream course and native grasses were re-established. The project was completed in 1999.
- Upper Santa Cruz Watershed Restoration – Lazy J2 Ranch proposes to install fencing and water developments by June 2003 to more evenly distribute livestock grazing impacts throughout the A Bar Draw Allotment in the San Rafael Valley. Nine dirt tanks will be cleaned. Three tanks provide habitat for the endangered Sonoran Tiger Salamander, and would be fitted with sediment traps, and partially fenced to exclude livestock use. The applicant will reconstruct two corrals to treat livestock without moving them to headquarters, two miles to the west.

According to the Forest Service, the allotment has insufficient vegetative cover and litter accumulation, which results in increased runoff and suspended sediment, and decreased water percolation. This degraded condition is the result of drought and improper grazing management grazing management by the prior permittee.

- Santa Cruz River Park Extension Project – The City of Tucson received funds to create a riparian and upland riparian habitat on a denuded 50 acre lot at the confluence of Irvington Wash and the Santa Cruz River. Seven acres near the wash will be planted with native riparian vegetation, and the remaining 40 acres will be mesquite bosque.

Vegetation will be established and supported with tertiary-quality reclaimed wastewater. The city is also to design and build a public access trail system with interpretive signs.

- Atturbury Wash Project – The city of Tucson Water Department was awarded Watershed Protection Funds to establish a sustainable five-acre riparian habitat along a one-half mile tributary of Atturbury Wash within Lincoln Regional Park. Secondary effluent produced at the city's Roger Road Reclaimed Wastewater Treatment Plant will be the source water for this project. The project has three major objectives:
 - ▶ Create interconnected wetlands and shallow ponds that will support planted emergent vegetation and create wildlife habitat;
 - ▶ Provide information on the capacity of small scale wetlands to reduce nitrogen levels in reclaimed wastewater; and
 - ▶ Provide water quality data down gradient of the wetlands.
- Redrock Riparian Improvement Project – Coronado National Forest was awarded funds to improved riparian conditions and expand Gila topminnow habitat in the Redrock Canyon watershed through a series of rangeland improvements. Fencing is to be replaced, an off-stream livestock water source is to be established, a cattle enclosure is to be extended, and a road will be rerouted to allow continued access by motor vehicles outside of the enclosure. The project is to be completed by 2003.
- Rillito Creek Habitat Restoration Project – The City of Tucson is to restore a mesquite bosque along a portion of the Rillito River, and provide recreational and educational opportunities for schools and the public. City staff will guide neighborhood and educational groups in the revegetation and maintenance efforts. This project will use reclaimed water to establish native plants. The project is to be completed in 2003.
- Cortaro Mesquite Bosque Project – Eight (80) acres of riparian habitat is to be established by Pima County Flood Control District on the flood plain terraces in the Town of Marana along the Santa Cruz River. The vegetation is to be irrigated by effluent from two Pima County wastewater treatment plants with supplemental irrigation from tributary

flow ponded on the flood plain terraces. This project is to be completed in 2003.

- Potrero Creek Wetland Characterization and Management Plan – EnviroNet, Inc. received funds to determine the source of water that sustains the wetland and riparian area along Potrero Creek, and to determine factors critical to its continuation as a wetland. The project also included a biologic and hydrogeologic evaluation of the area's potential for habitat improvement or habitat replication, and the development of a wetland management plan. The project was completed in 1997.
- Riparian Restoration on the San Xavier Indian Reservation – The San Xavier District of the Tohono O'odham Tribe evaluated various options for restoring riparian areas on their lands. Sites for riparian restoration were chosen base on physical and biological conditions and community preference. A restoration plan was developed. The project was completed in 1999.
- Sabino Creek Riparian Ecosystem Protection Project – In 1998, the Hidden Valley Homeowners Association received Watershed Protection Funds to measure stream flow in Sabino Creek in support of an application for non-consumptive, in-stream flow water right for a reach of Sabino creek. The project area is a privately owned natural riparian park owned by the homeowners association in Tucson.

Sonoran Desert Conservation Plan --The Sonoran Desert Conservation Plan "combines short-term actions to protect and enhance the natural environment with long-range planning to ensure that our natural and urban environments not only coexist but develop an interdependent relationship where one enhances the other. The action plan will guide approved public bond investment and preservation actions, establish federal program and funding priorities, and develop our region's preference for the expenditure of State funds to preserve and protect State Trust lands threatened by urbanization." This plan has lead to the following projects.

- The Cienega Creek Natural Preserve – Nearly 4000 acres along a 12-mile long reach of Cienega Creek has been acquired to preserve one of the region's few remaining perennial streams. Establishment of the

preserve in 1986 marked Pima County's first major flood control effort that included riparian habitat preservation. In response to eliminating cattle grazing and off-road vehicle activity, the density of cottonwoods, willows and other trees and shrubs along the stream have increased dramatically and channel erosion has decreased and water quality has decreased.

- Over 23 miles of river parks have been constructed along the Santa Cruz River, Rillito Creek, and Tucson Diversion Channel. These parks are used by thousands of people each week to relax and exercise. The channel bottoms offer one of the few locations for horse use in the growing urban area.
- Pima County Flood Control District Projects -- Other water course protection will be explored when the Pima County Flood Control District works with landowners to protect the flood prone areas from future development through conservation easements and acquisitions. Using bonds approved by voters in 1997, lands along Sabino Creek, Honey Bee Wash, Bear Canyon, Tanque Verde Wash, San Pedro River, and Agua Caliente Wash will be preserved, protecting and/or enhancing water quality. Pima County will encourage the setting aside of state trust land along significant corridors such as Cienega Creek, Mescal Arroyo, Davidson, and Penitas Wash, among others.
- The "Pantano Jungle" Restoration Project -- This project is to re-establish vegetation typical of mesquite woodland and riparian grassland on a site along Pantano Wash (formerly known as the "Jungle") that was cleared for pasture. Native trees and grasses are now being planted to improve the nature of land for wildlife use. Volunteers have installed check dams and other measures to reduce erosion. The project is funded by the U.S. Fish and Wildlife Service and the Arizona Game and Fish Department.
- Rillito Recharge and Habitat Restoration -- This project helps restore wetlands and riparian habitat along the south bank of the Rillito river west of Swan Road using reclaimed treated wastewater will be transported from the Roger Road treatment plant. A park will be constructed on the north bank of the river. On-site storm water runoff will also be directed to the wetlands as well as to vegetated areas around them. In addition, Pima County Flood Control Department and the City

of Tucson are cooperating on two other projects just upstream: a pilot recharge project and wildlife habitat project (see Water Protection Fund projects discussed above).

- Tucson/Ajo Detention Basin – A 27 acre wetland and riparian habitat is to be constructed in a 120-acre flood control basin located just north of Ajo Way and west of Country Club Road in Tucson. A state-of-the-art stadium, Tucson Electric Park, opened in 1999. This park is irrigated with reclaimed wastewater effluent and storm water captured in the basin.
- The City of Tucson and Pima County have agreed to set aside up to 10,000 acre-feet of treated effluent per year for riparian projects. The effluent can be delivered to sites via the reclaimed water system or other means.
- Agua Caliente Restoration – Habitat for large, self-sustaining populations of native aquatic animals can be recreated at Agua Caliente park. This project is being studied by the US Army Corps of Engineers and Pima County.
- Cienega Creek Stream Flow Restoration Project -- One to five miles of stream flow could be restored by acquiring a one-acre inholding within the Cienega Creek Natural Preserve, transforming what is now an ephemeral stream into a lush riparian area similar to other reaches within the Preserve. The inholding contains two key features, a surface-water diversion dam and a well as a stream flow gaging station used by the U.S. Geological Survey and Pima County Flood Control District. By acquiring the inholding and the associated water rights the stream can be made whole again. To do this, the Vail Water Company will need a replacement source of water for its development, either ground water pumped from outside the preserve, effluent, or Central Arizona Project Water (CAP).
- The Rincon Creek Restoration Project – This project is located south of Saguaro National Park's Rincon Mountain Unit. A 600-foot wide riparian-woodland corridor along two miles of the creek is to be restored using a combination of private and public funding. The project is a requirement of Pima County Zoning and Section 404 permits. Most of the native trees and shrubs have been removed and the stream channel has been destabilized due to farming and erosion without the

use of visually or physically intrusive structures. Other restoration components include planting, ground water monitoring, and removing livestock. A multi-use trail system within the restore flood plain will provide access to Saguaro National Park.

Water Quality Improvement Grants – ADEQ awarded the following Water Quality Improvement Grants in this watershed.

- Santa Cruz River Sediment Control – This project is to restore 1000 feet of the Santa Cruz River channel that runs through the Santa Fe Ranch. This site is five miles northeast of Nogales. The project is designed to reestablish a healthy riparian corridor that functions to filter sediment and other non-point source pollutants from the river channel while increasing channel stability by installing Kellner jacks for grade stabilization and by revegetation of riparian areas. An educational component includes workshops, brochures, and newsletters. For more information contact the Coronado Resource conservation and Development Area, Inc. at (520) 384-2229.
- The Rillito Wash Recharge and Habitat Restoration Project – This project is to restore wetlands and riparian habitat, whereby improving water quality, along the south bank of the Rillito River west of Swan Road. A park will be constructed on the north bank of the River. Water supply for the project will consist of reclaimed treated wastewater transported from the Roger Road Treatment Plant. On-site storm water runoff will be directed to the wetlands as well as to vegetated areas around them. In addition, the Pima County Flood Control District is cooperating with the City of Tucson on two other projects upstream -- a pilot recharge project and a wildlife habitat project, both of which will be located on District land east of Swan Road. Cooperators include Pima County, City of Tucson, and the U.S. Army Corps of Engineers.

Ground Water Studies And Mitigation Projects

The Upper Santa Cruz Basin Study – Fifty-eight ground water samples were collected and analyzed in 1998 by the U.S. Geological Survey and ADEQ to assessing ground water quality and identify contaminant sources within the Upper Santa Cruz Basin (Coes, et al., 2000). At least one constituent exceeded state water quality standards in 29% of the samples collected. These constituents included arsenic, fluoride, nitrite (plus nitrate), iron, manganese, pH, sulfate, and

dissolved solids.

Factors influencing the regional ground water quality include aquifer depth and proximity to major faults and anthropogenic factors such as recharge from agricultural uses. For more information, please contact the ADEQ Ground Water Monitoring Unit at (602) 771-4412.

Casa Grande Area Study – Situated in Pinal County, the Casa Grande study area encompassed more than 24 square miles. This study area included areas where recent residential development has been concentrated and there is a potential for elevated nitrate levels.

In this study, ADEQ concluded that elevated nitrate levels exist in the northern and southwestern portions of the study area. Potential sources may include malfunctioning septic systems, wastewater discharges, and agricultural runoff. These may also be the sources of elevated levels of chloride, sulfate and total dissolved solids. Elevated levels of arsenic, fluoride and pH may be due to the weathering of sediments derived from igneous rocks. For more information, please contact the ADEQ Ground Water Monitoring Unit at (602) 771-4412.

Hydrogeologic Investigation of Sonoita Creek – The Nature Conservancy was awarded Watershed Protection Funds to generate Hydrogeologic data from ground water monitoring wells and assist in determining sources of ground water discharge that sustain base flow in the perennial reach of Sonoita Creek. The project looked at ground water movement and sources of base flow in Sonoita Creek and implemented a long-term monitoring program.

Federal and State Superfund Cleanup Sites – Twelve WQARF, National Priority List, and Department of Defense Superfund cleanup sites are located in this watershed.

- Tucson International Airport Area – This 24 square mile area contains seven major project areas including: Air Force Plant 44, Tucson Airport Remediation Project, the Airport Property, the Arizona Air National Guard 162nd facility, Texas Instruments Tucson Corporation, the former West Cap property, and west plume B. Ground water investigations have defined a contamination plume in the regional aquifer consisting mainly of trichloroethene (TCE), with smaller amounts of dichloroethene (DCE), chloroform, and chromium. This plume extends from Air Force Plant 44 north past Irving Road. Ground

water pump-and-treat systems and soil vapor extraction systems are among the treatment technologies presently being employed to address contamination of soils and ground water in the area.

- 162 Air National Guard Site – The Arizona Air National Guard 162nd Tactical Fighter Group occupies 84 acres of the Tucson International Airport Area site, along Valencia Road in Tucson. The base has been a training facility for tactical fighter aircraft. The primary ground water contaminant at this site is trichloroethene (TCE). Approximately 110 gallons per minute is being pumped from the ground water, treated, and then reinjected into the ground. A soil vapor extraction system was started on April 3 1997 and shut down on November 29, 1997, after achieving complete soil remediation.
- Raytheon Air Force Plant # 44 – The Raytheon Air Force Plant #44, located in the southern portion of the Tucson International Airport Area, is a federally owned weapons manufacturing facility operated under contract by the Raytheon Corporation (formally Hughes). Historic waste disposal operations at the plant resulted in soil and ground water contamination of metals and volatile organic compounds including trichloroethene (TCE). Remediation activities include large-scale pumping, treating, and reinjecting ground water; soil vapor extraction systems; dual-phase extraction systems; and soil excavation and removal.
- Davis Monthan Air Force Base – The entire Davis Monthan Air Force Base in Tucson is included in the Department of Defense study site. Contamination at the base has been primarily surface soil contamination with petroleum wastes, waste piles of hazardous aluminum dross, and a large volume underground jet fuel leak. Aluminum dross on the base (residue from past melting of obsolete aircraft) has been treated by solidification-stabilization, and has been transported to an off-site landfill.
- Broadway-Pantano site – The Broadway-Pantano site is located in east-central Tucson and includes 130-acre Broadway North Landfill. This site was first put on the WQARF Registry in 1998. Ground water is contaminated by tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride at concentrations exceeding Arizona's aquifer protection standards and drinking water standards. PCE and TCE are volatile

solvents commonly used in dry cleaning and metal cleaning operations, and vinyl chloride is often an end product when PCE and TCE chemically decomposed in the environment.

- El Camino del Cerro site – This site in northwest Tucson contains the closed 20-acre El Camino del Cerro Landfill. It was placed on the WQARF Registry in 1998 primarily due to contamination by tetrachloroethene (PCE), trichloroethene (TCE), vinyl chloride, benzene, and methane.
- Los Reales Landfill site – The Los Reales Landfill is an active municipal sanitary landfill in southeast Tucson. The site was placed on the WQARF Registry in 1999 with ground water contamination by volatile organic compounds. Several VOCs have been detected in down-gradient monitoring wells, including: tetrachloroethene (PCE), trichloroethene (TCE), trichlorofluoromethane, dichlorofluoromethane, chloroethane, 1,1-dichloroethene (DCE), methylene chloride, and 1,1-dichloroethane (DCA). Up-gradient wells have not had detectable levels of VOCs.
- Miracle Mile site – The Miracle Mile site in Tucson was placed on the WQARF Registry in 1998 with ground water contamination by at least seven different volatile organic chemicals. The predominant contaminants are trichloroethene (TCE), tetrachloroethene (PCE), dichlorodifluoromethane (Freon 12), trichlorofluoromethane (Freon 11), 1,1-dichloroethene (DCE), and methyl tertiary butyl ether (MTBE). Benzene and chromium have each exceeded Arizona's aquifer protection standards in at least one well at the site.
- Park-Euclid site – This site in Tucson includes facilities on South Park, where several companies conducted laundry and dry-cleaning operations since the late 1930s. The site was placed on the WQARF Registry in 1999. Ground water contamination is a combination of diesel free product and volatile organic compounds, including tetrachloroethene (PCE), trichloroethene (TCE), and 1,1-dichloroethene (DCE).
- Shannon Road - Rillito Creek site – This Tucson site extends approximately one quarter mile north and south of Rillito Creek. This site was placed on the WQARF Registry in 1999 with ground water

contamination by tetrachloroethene (PCE), trichloroethene (TCE). As remedial investigations proceed, the extent of contamination will be further defined. Other VOCs have been detected at this site but below regulatory limits.

- Silverbell Jail Annex Landfill – This site was placed on the WQARF Registry in 1999. Investigations have discovered a ground water plume consisting of solvents tetrachloroethene (PCE), trichloroethene (TCE). Other VOCs routinely detected in monitoring wells include vinyl chloride, dichlorodifluoromethane, trichlorofluoromethane, methylene chloride, and cis-1,2-dichloroethene (DCE).

Watershed Partnerships

Friends of the Santa Cruz River – The Friends of the Santa Cruz River was established by community members to “preserve and enhance water quality and perennial flow of the upper Santa Cruz River.” Member volunteers have helped ADEQ collect fecal coliform and chlorine samples in the upper Santa Cruz River. The data generated was used in making assessments in this report

For information about meetings and activities, contact Mark Larkin at (520) 398-9093.

Upper Gila Watershed 2002 Assessment



UPPER GILA WATERSHED CHARACTERISTICS

SIZE	7,354 square miles (6% of the state's land area).					
POPULATION BASE	Approximately 51,500 people live in this watershed (estimated from the 2000 census). This is about 1% of the state's population.					
LAND OWNERSHIP (Figure 51)	Tribal	28%	US Forest Service	23%	Private	9%
	Bureau of Land Management	22%	State	14%	Other state and federal	4%
LAND USES AND PERMITS (Figure 52)	<p>Safford is the largest community in this watershed. In the Safford area, irrigated agriculture uses a high percentage of Gila River flow. Outside the Safford area, land use is primarily grazing and recreation with a minor amount of silviculture in the national forests. A major mining facility is located in the Clifton-Morenci area along the San Francisco River.</p> <p>In 1990, Congress passed the Arizona Desert Wilderness Act that designated the Gila Box Riparian National Conservation Area, and directed the BLM to conserve, protect, and enhance the riparian and wetland areas within the conservation area. There are also five designated Wilderness Areas and a Wilderness Study Area on Mount Graham that have restricted land uses.</p>					
HYDROLOGY AND GEOLOGY	<p>This watershed is defined by the Gila River drainage area from New Mexico to Coolidge Dam (San Carlos Reservoir). Perennial flow is limited to the Gila River above Safford, the San Francisco sub-watershed, Eagle Creek, the lower portion of Bonita Creek, a portion of the San Carlos River, and short stretches of tributaries on Mount Graham and Chiricahua Mountains. (Brown et al. 1978). The flow in the Gila River above the Safford Valley ranges from 11 cfs (in 1956) to 132,000 cfs (in 1983), with an annual mean of 477 cfs (USGS 1996).</p> <p>Ground water basins include: Bonita Creek, Duncan Valley, Morenci, and Safford. The Safford and Duncan ground water basins are large trough-like depressions formed by elongated mountain ranges composed of gneiss, schist, granite, volcanic material, and sedimentary rocks. These mountains rim a broad, alluvial-filled valley composed of the erosional remnants of these mountains. This alluvial fill constitutes the major aquifer in the Safford and Duncan Basins. Average discharge from wells is 1,000 gallons per minute. Ground water levels and movement in these two basins are strongly influenced by the Gila River (ADWR 1994). The Bonita Creek and Morenci ground water basins, within the Central Highlands province, have limited ground water resources. Most wells tap alluvial deposits along the major stream courses while the surrounding hardrock areas produce limited ground water quantities (ADWR 1994).</p> <p>The Hydrological Province is primarily the Basin and Range Province, but the northern third falls within the Central Highlands Province.</p>					
UNIQUE WATERS	Designated Unique Waters in 2001: Bonita Creek, Cave Creek, and the South Fork of Cave Creek.					
ECOREGIONS	Primarily Southern Deserts. Northern edge in Arizona-New Mexico Mountains.					
OTHER STATES, NATIONS, OR TRIBES	San Carlos Apache Indian tribe is a significant stakeholder in this watershed with 58% of the watershed on tribal lands. Approximately 5,000 square miles of this watershed's drainage area extends into New Mexico.					

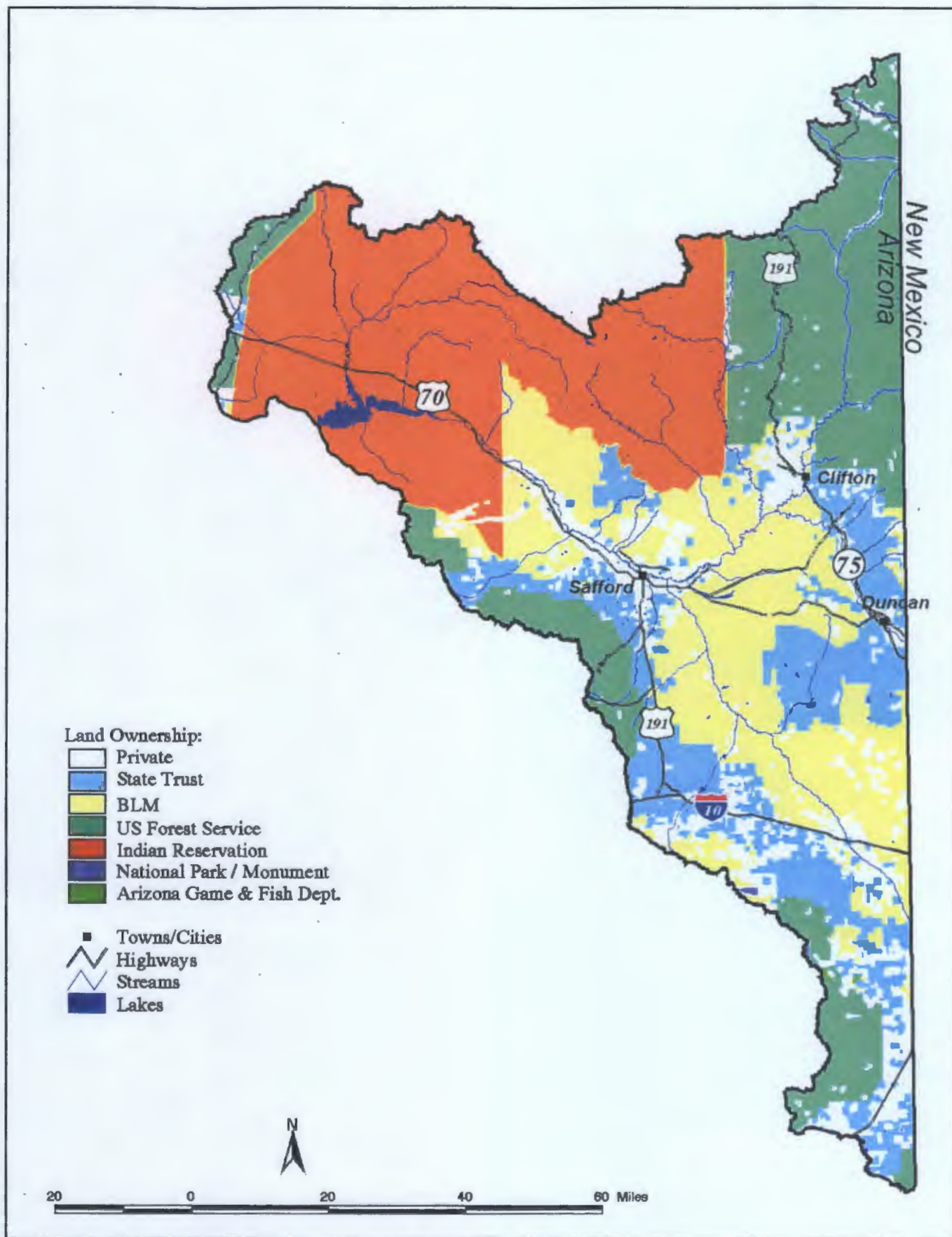


Figure 51. Land Ownership in the Upper Gila Watershed